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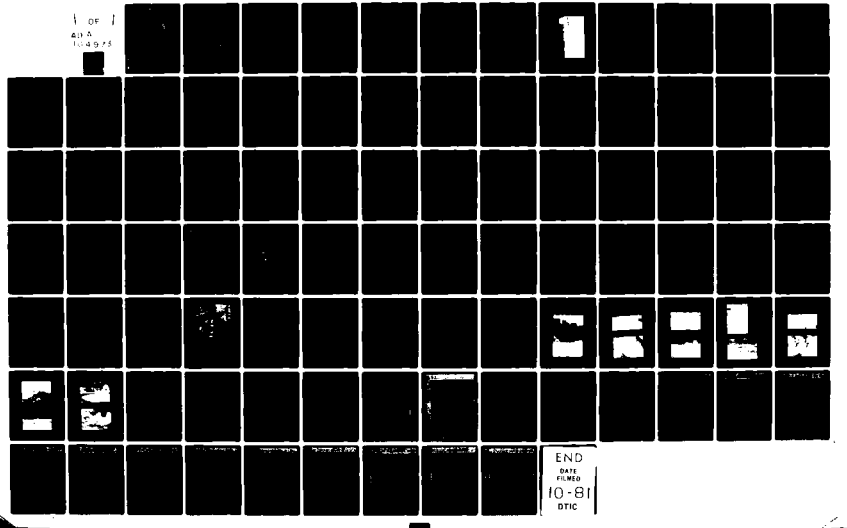

LEVEL II

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MISSISSIPPI · SALT · QUINCY RIVER BASIN

PERRY CITY DAM NO. 2
RALLS COUNTY, MISSOURI
MO. 10980

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Perry City Dam No. 2 (MO 10980) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Perry City Dam No. 2.

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria.

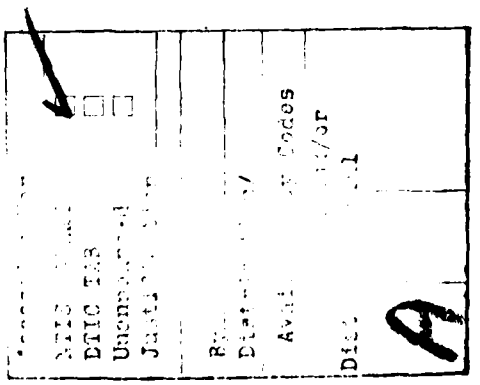
1) The spillway capacity of this dam will not pass 50 percent of the Probable Maximum Flood.

2) Overtopping of the dam could result in failure of the dam.

3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: Signed
Chief, Engineering Division — 8 JAN 1981 Date

APPROVED BY: Signed
Colonel, CE, District Engineer — 9 JAN 1981 Date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PERRY CITY DAM NO. 2
RALLS COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
CONSOER, TOWNSEND AND ASSOCIATES, LTD.
ST. LOUIS, MISSOURI
AND
PRC ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

DECEMBER 1980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Perry City Dam No. 2, Missouri Inv. No. 10980
State Located: Missouri
County Located: Ralls
Stream: Mace Branch of Lick Creek
Date of Inspection: July 12, 1980

Assessment of General Condition

Perry City Dam No. 2 was inspected by the engineering firms of Consoer, Townsend and Associates, Ltd. of St. Louis, Missouri, and PRC Engineering Consultants, Inc., of Englewood, Colorado (A Joint Venture) according to the U. S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Within the estimated damage zone of four miles downstream of the dam there are three dwellings, a trailer and a dam (Mo. 10675) which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Perry City Dam No. 2 is in the small size classification since it is 13 feet high, and impounds more than 50 acre-feet but less than 1,000 acre-feet of water.

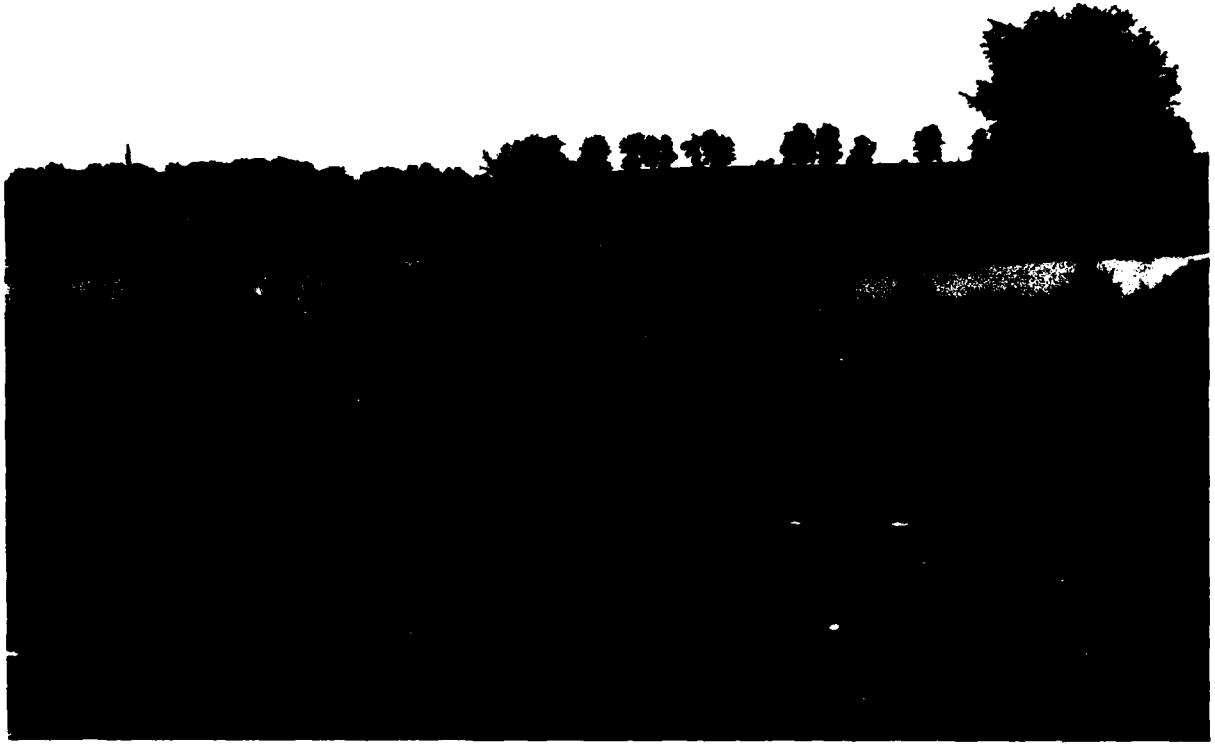
The inspection and evaluation by the consultant's inspection team indicate that the spillway of Perry City Dam No. 2 does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Perry City Dam No. 2 being a small size dam with a

high hazard potential is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping. Considering the number of inhabited dwellings located downstream of the dam and another dam being located on the same stream approximately 0.2 miles downstream of the dam, the PMF is considered the appropriate spillway design flood for Perry City Dam No. 2. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. It was determined that the reservoir/spillway system can accommodate approximately 25 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation also indicates that the reservoir/spillway system cannot accommodate the one-percent chance flood (100-year flood) without overtopping; however, the reservoir/spillway system will accommodate the ten-percent chance flood (10-year flood) without overtopping the dam.

Other deficiencies noted by the inspection team were as follows: trees and brush were growing on the upstream and downstream slopes; erosion was occurring on the upstream and downstream slopes, in the emergency spillway, at the downstream end of the principal spillway, and behind the left retaining wall of the principal spillway; there were joint displacements and minor deterioration of the concrete in the principal spillway; a need exists for periodic inspection by a qualified engineer; and there also exists a lack of a maintenance schedule. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

Walter G. Shifrin, P.E.



Overview of Perry City Dam No. 2

NATIONAL DAM SAFETY PROGRAM

PERRY CITY DAM NO. 2, I.D. No. 10980

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NATIONAL DAM SAFETY PROGRAM

PERRY CITY DAM NO. 2, Missouri Inv. No. 10980

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Perry City Dam No. 2 was carried out under Contract DACW 43-80-C-0094 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of Consoer, Townsend & Associates, Ltd., of St. Louis, Missouri, and PRC Engineering Consultants, Inc., of Englewood, Colorado (A Joint Venture).

b. Purpose of Inspection

The visual inspection of Perry City Dam No. 2 was made on July 12, 1980. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, presents a summary of visual observations made during the field inspection, presents an assessment of hydrologic and hydraulic conditions at the site, and of the structural adequacy of the various project features and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that in this report reference to left or right abutments is viewed as looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the south abutment or side, and right abutment or right side of the dam to the north abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase 1 Dam Inspection.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based upon design drawings, observations, and measurements made during the visual inspection and from conversations with Mr. Ernest Elliot, a representative of the Perry City Water Department. Any discrepancies between the design drawings and our field measurements will be noted. The design drawings are included in this report (see Plates 4 through 8).

The dam is a rolled earthfill structure with a straight alignment between earth abutments. A plan and elevation of the dam are shown on Plate 2 and Photos 1 through 3 show views of the dam. According to the drawings, the embankment was supposed to be zoned; however, according to Mr. Elliot, the dam is homogeneous and not constructed with three different zones. The dam was constructed with a cutoff trench extending at least 2 feet into the foundation soils. Plans noted a thin surficial silt layer beneath the dam.

The top of dam width is 25 feet and the axis length of the crest of the embankment was measured as 648 feet. According to the design drawings, the top width was to be 20 feet. The emergency spillway, which is located at the left abutment contact, is 70 feet wide. This gives a total length of 718 feet from the left abutment contact to the edge of the principal spillway channel. The top of dam elevation at the maximum section is 688.75 feet above mean sea level (M.S.L.) and was measured to be level. It was not possible to measure the height of the dam because of the downstream reservoir water level. However, the height of the dam from the top of dam to the water surface of the downstream reservoir was measured to be 12.00 feet and according to the design drawings, the structural height was to be 13 feet. The upstream slope was measured to be 1 vertical on 3 horizontal (1V on 3H) and has no riprap protection. The downstream slope measurement was 1V on 3H. The entire embankment is covered with a protective grass cover.

There are two spillways at this damsite that are referred to in this report as the principal and the emergency spillway. The principal spillway is a reinforced concrete weir connected to a chute discharge channel. Field measurements show that the spillway was constructed as indicated on the design drawings. The design drawings for the spillway are shown on Plates 6 and 7. The control section is rectangular in shape, is 50 feet wide, and has an assumed crest elevation of 683.0 feet above M.S.L. (The elevation of 683 feet is shown on the Perry, Missouri 7.5 Minute Quadrangle sheet as the normal water surface for the reservoir; however, the design drawings show the crest elevation as 682.5 feet.) The spillway channel has a total length of about 79 feet. Vertical retaining walls, which were provided with weep holes, line the spillway channel. A 9-inch high and 12-inch wide wall was constructed about 12 feet upstream from the downstream end of the spillway as an energy dissipator (see Photo 5). According to the design drawings, a system consisting of crushed rock and 4-inch and 6-inch farm tile drains was provided under the spillway slab as an underdrain and four cutoff walls were also provided. The spillway discharges directly into the reservoir downstream of the dam and is cut into the right abutment.

The emergency spillway is an earthcut, grass-lined channel cut into the left abutment (see Photo 2). At the control section of the spillway, the channel is trapezoidal in shape with a bottom width of 46 feet, a top width of 70 feet, and side slopes of about 1V on 3H. According to the design drawings, the bottom width of the channel was to be 60 feet. At the control section, the spillway channel was measured to be about 0.5 feet lower on the left side than on the right side. The minimum crest elevation was found to be 684.75 feet above M.S.L., assuming the crest of the principal spillway at 683 feet above M.S.L. The spillway wraps around the dam embankment until the discharge channel of the spillway almost parallels the embankment. The spillway discharges directly into the reservoir downstream of the dam.

A regulated outlet works was constructed at the damsite for use in the Perry, Missouri, water supply system. Water is drawn through a 6-inch pipe from the reservoir by two centrifugal pumps that have a capacity of 100 gallons per minute each and are located in the water treatment plant (see Photo 10). The 6-inch line runs from the water treatment plant located near the downstream dam to a 4-foot square concrete standpipe located in the reservoir (see Photo 1). The standpipe, according to the design drawings, appears to have two intakes that are at different elevations; one is controlled and the other is not (see Plate 7). The controlled intake is controlled by a 6-inch gate valve that is operable by a hand wheel located on top of the standpipe and has an inlet elevation of 678 feet above M.S.L. The other intake has a inlet elevation of 681 feet above M.S.L. The 6-inch line which runs to the water treatment plant has another 6-inch line connected to it that exits into the downstream reservoir. This 6-inch pipe is controlled by a gate valve and allows the upper reservoir to be drained into the lower reservoir. The entire system is operable, according to Mr. Elliot, and the pumps were operating on the day of the inspection.

b. Location

Perry City Dam No. 2 is located in Ralls County in the State of Missouri, and crosses the Mace Branch tributary of Lick Creek. The small community of Perry is about 0.5 miles to the north. The Perry City Dam No. 2 location on the 7.5 minute series of the U.S. Geological Survey maps is found in Section 34 of Township 54 North, Range 7 West of the Perry, Missouri Quadrangle Sheet.

c. Size Classification

The impoundment of Perry City Dam No. 2 is less than 1,000 acre-feet but more than 50-acre feet, and the height is 13 feet. Therefore, the size is determined to fall in the "small" category, according to the "Recommended Guidelines for Safety

Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with this classification. Within the estimated damage zone, extending four miles downstream of the dam, there are three dwellings, a trailer, plus another dam (Mo. 10675). The contents of the damage zone have been verified visually by the field inspection team.

e. Ownership

Perry City Dam No. 2 and Reservoir is owned by the City of Perry. All correspondence is directed to Mr. E. Elliot, Water Superintendent, Perry City. His mailing address is as follows: Perry Public Utilities, Perry, Missouri, 63462.

f. Purpose of Dam

The dam was constructed in 1964 to create an impoundment for additional water supply for the City of Perry, Missouri.

g. Design and Construction History

According to Mr. Elliot, the dam was designed in 1964 by Frank Beard and H. W. Thomas of Salisbury, Missouri. The purpose of the lake is to impound water for municipal water supply. Water can be pumped directly into the water plant, or it can be drained into the lake below.

According to Mr. Elliot, the dam was constructed by Tyhurst Construction Company, of Carolton, Missouri. Efforts to contact the builder were futile.

Mr. Elliot claims that the dam has a clay foundation and that a sheepsfoot roller was used for compaction.

h. Normal Operational Procedures

Normal operational procedure is to allow the reservoir to remain as full as possible while the water level is controlled by rainfall, runoff, evaporation, and the elevation of the principal spillway crest. The water level also varies according to the amount of water pumped into the treatment plant or drained into the lower reservoir.

1.3 Pertinent Data

a. Drainage Area (square miles):. 2.34

b. Discharge at Damsite

Estimated experienced maximum flood (cfs): 800

Estimated ungated spillway capacity with reservoir at top of dam elevation (cfs): 3,139

c. Elevation (Feet above M.S.L.)

Top of dam: 688.75

Spillway crest:

Principal Spillway*. 683

Emergency Spillway 684.75

Normal Pool: 683

Maximum Experienced Pool:. 686

Observed Pool: 682.8

d. Reservoir

Length of pool with water surface at top of dam elevation (feet):. 2100

e. Storage (Acre-Feet)

Top of dam:. 113

Spillway crest:

Principal Spillway 32

Emergency Spillway 52

Normal Pool: 32

Maximum Experienced Pool:. 70

Observed Pool: 31

f. Reservoir Surfaces (Acres)

Top of dam: 18

Spillway crest:

Principal Spillway 9

Emergency Spillway	13
Normal Pool:	9
Maximum Experienced Pool:	15
Observed Pool:	9

g. Dam

Type:	Rolled Earthfill
Length:	648 feet
Structural Height:	13 feet (According to design drawings)
Hydraulic Height:	13 feet
Top width:	25 feet
Side slopes:	
Downstream	1V on 3H
Upstream	1V on 3H (Above water surface)
Zoning:	Homogeneous
Impervious core:	NA
Cutoff:	Cutoff trench into soil foundation
Grout curtain:	None
Volume:	16,000 cu.yds. (Estimated)

h. Diversion and Regulating Tunnel . . . None

i. Spillway

Type:	
Principal Spillway	Rectangular concrete weir and chute channel, uncontrolled
Emergency Spillway	Earthcut channel, uncontrolled

Length of crest:

Principal Spillway	50 feet
Emergency Spillway	46 feet

Crest Elevation (feet above M.S.L.):

Principal Spillway	683 (assumed)
Emergency Spillway	684.75

j. Regulating Outlets

Type:	Water Supply System
Length:	Unknown
Closure:	6-inch gate valve
Maximum Capacity:	100 gpm (each)

* The elevation of the crest of the principal spillway is assumed from the U.S.G.S. Perry, Missouri Quadrangle topographic map. The elevations of other features of the dam are obtained by using this elevation and field measurements.

SECTION 2: ENGINEERING DATA

2.1 Design

A full set of plans was obtained through the Perry City Water Superintendent, Mr. E. Elliot. The plans are dated March 1964 and show the dam and appurtenant structures. No pertinent data were available concerning design hydrology or flood routing.

2.2 Construction

No construction records or data are available for Perry Ctiy Dam No. 2.

2.3 Operation

No operational records are available for Perry City No. 2.

2.4 Evaluation

a. Availability

The only valid data available for this dam was the set of plans obtained from the Water Superintendent. No design computations, construction data or operation data are available. Also, no pertinent data were available for review of hydrology, spillway capacity, flood routing through the reservoir, outlet capacity, or foundation conditions. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available.

b. Adequacy

The lack of engineering data did not allow a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance history, and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions and made a matter of record.

c. Validity

A set of drawings was available for review. From field measurements and conversations with Mr. E. Elliot, the dam appears to have been constructed according to the available drawings except for the discrepancies described in Section 1.2a.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Perry City Dam No. 2 was made on July 12, 1980. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Dr. M.A. Samad	PRC Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Mark Haynes, P.E.	PRC Engineering Consultants, Inc.	Civil and Mechanical
Zoran Batchko	PRC Engineering Consultants, Inc.	Soils
Razi Quraishi, R.P.G.	PRC Engineering Consultants, Inc.	Geology
Kevin J. Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural
Ernest Elliot	Perry Public Utilities	Water Superintendent
Buster McClain	Perry Public Utilities	

Specific observations are discussed below.

b. Dam

The top of dam and the upper exposed slopes of the embankment have a grass cover that adequately protects the embankment from surface erosion (see Photo 2). Both embankment slopes have no riprap protection and are, consequently, eroded by wave action in the respective reservoirs (see Photo 4). Nearly vertical faces up to 3 feet high are exposed. According to Mr. Elliot, the dam has never been overtopped and no evidence indicating the contrary was observed.

Both embankment slopes had large to intermediate-sized trees and bushes growing at or near the water surfaces. The left downstream abutment area inside of the emergency spillway area is low-lying and covered with tall grasses.

The right embankment and abutment areas adjacent to the principal spillway show signs of high water flows through the principal spillway. The right abutment slope, extending from just upstream of the spillway to a point approximately 100 feet upstream, is nearly vertical and 5 feet high. Downstream of the spillway, even though riprap has been placed in the channel, nearly vertical faces up to 2 feet high in an area that extends from the downstream end of the spillway to a point approximately 30 feet downstream are exposed in both the abutment and the embankment.

There is no evidence of seepage or leakage through the embankment.

No signs of past or present instability were observed on the embankment except for both wave-eroded slopes and the erosion at the principal spillway.

The left abutment slopes gently upward from the crest and the right abutment is nearly horizontal. Instabilities that could affect the safety of the dam, as described above, were evident at the right abutment due to the continued sloughing of the right abutment slopes. No evidence of burrowing animals was observed on either the abutment or the embankment.

The downstream reservoir (see Photo 3 and 5) will add to the stability of Perry City Dam No. 2 if it remains full and backs up against the Perry City Dam No. 2. However, in case the downstream dam fails, this will be detrimental to the stability of Perry City Dam No. 2. The crest of the principal spillway of Perry City Dam No. 2 is approximately 6-1/2 feet higher than the crest of the principal spillway of the downstream dam (MO. 10675), and the top of Perry City Dam No. 2 is approximately 5.75 feet higher than the top of the downstream dam (MO. 10675). Thus, the tailwater probably will not affect the flow from the upstream reservoir to the downstream reservoir.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on the Mace Branch of Lick Creek in the Dissected Till Plains Section of the central Lowland Physiographic Province. Loess-mantled Kansas Drift covers the surface of most of the Dissected Till Plains Section. This section is distinguished from the Young Drift Section to the north and from the Till Plains on the east by the stage it has reached in the post-glacial erosion cycle. Broadly generalized, this section is a nearly flat till plain submature to mature in its erosion cycle.

The topography at the damsite is rolling with gentle slopes. Elevations of the ground surface range from 680 feet above M.S.L. at the damsite to 745 feet above M.S.L. approximately one mile east of the damsite. The reservoir rim slopes are in the range

of 7° from the horizontal. The reservoir slopes appear to be stable and free of potential slide activity. The area near the damsite is covered with slope wash of glacial-fluvial deposits and loess consisting of yellowish brown to grayish brown, silty clay.

The regional bedrock geology beneath the glacial outwash deposits in the damsite area as shown on Geologic Map of Missouri (1977) (see Plate 9), consists of the Pennsylvanian Pleasanton-Marmaton-Cherokee Group (cyclic deposits of shale, limestone, and sandstone), Mississippian age rocks consisting of Burlington Limestone and the Chouteau Group, the Devonian Sulphur Springs Group, and Ordovician rocks consisting of Maquoketa Shale, Kimmswick Limestone, and the Decorah Formation. The predominant bedrock near the site underlying the glacial-fluvial deposits consists of the Pennsylvanian Marmaton-Cherokee Group rocks and the Mississippian Burlington Limestone.

Outcroppings of Mississippian whitish green siltstone is exposed at the downstream spillway channel of Perry City Dam No. 1 (which is located downstream of Perry City Dam No. 2) (see Photo 11). Inlet and outlet areas of the Mace Branch of Lick Creek contain Quaternary alluvium.

No faults have been identified in the vicinity of the damsite. The closest trace of a fault to the damsite is Cap Au Gres faulted flexure nearly 20 miles southeast of the damsite. The Cap Au Gres faulted flexure had its last movement in post-Pennsylvanian, pre-Pleistocene time. Thus, the fault has no effect on the dam.

Perry City Dam No. 2 consists of a homogeneous earthfill embankment, a concrete chute spillway located adjacent to the right abutment, and a grass-lined emergency spillway located at the left abutment. A partly submerged, low-level intake structure with a built-in 6-inch diameter metallic pipe is located in the reservoir.

Based on the available data, conversations with Mr. Ernest Elliot, and the visual inspection, the embankment rests on glacial-fluvial deposits consisting of brown, silty clay, with a core trench excavated into the glacial-fluvial deposits. The concrete chute spillway is cut into the compacted embankment fill (grayish brown, clayey silt). The emergency spillway is cut into the left abutment and the low-level intake structure rests on the glacial-fluvial deposits.

(2) Project Soils

According to the "Missouri General Soil Map and Soil Association Descriptions", published by the Soil Conservation Service, the materials in the general area of the dam belong to the soil series of Mexico-Leonard-Armstrong-Lindley in the Central Claypan Area. The soils were basically formed from loess and glacial till. The permeability of these soils ranges from moderately slow to very slow. The Lindley soil is generally quite susceptible to erosion. It is unknown whether the Lindley soil type was used in the embankment; however, if the soil type was indeed used, the potential of failure of the embankment would be increased due to erosion during overtopping.

Materials were removed from the embankment on the downstream and upstream slopes. The material removed from the downstream slope was a dark brown, low plasticity, silty clay to clayey silt. Based on the Unified Soil Classification System, the soil would be classified as a ML-CL. This soil type generally has the following characteristics: it is semipervious to impervious with a coefficient of permeability less than 100 feet per year, has medium shear strength and low to intermediate resistance to piping and erosion. The material removed from the upstream slope was a mottled gray, red and brown, moderately plastic silty clay with a trace of fine gravel. Based upon the Unified Soil Classification System, the soil would probably be classified as a CL. This soil type generally has the following characteristics: it is impervious with a coeffi-

cient of permeability less than 100 feet per year, has medium shear strength and an intermediate resistance to piping and erosion.

d. Appurtenant Structures

(1) Principal Spillway

The slab of the spillway showed signs of differential movement and displacements of up to 1/2 of an inch were observed at the construction joints. The concrete of the spillway showed only minor deterioration. Minor shrinkage cracks, small popouts, and minor spalling were observed. The concrete slab of the channel does not appear to be undermined; however, the backfill at the downstream end of the spillway has been eroded away by flows through the spillway and has exposed a portion of the cutoff wall (see Photo 6). Riprap was placed at the downstream end of the spillway to prevent this problem, according to the design drawings (see Plate 6); however, it does not appear to have been effective. The wingwalls of the spillway appeared to be stable; however, erosion is eating the backfill away from the downstream end of the left wingwall (see Photo 7). The cause of the erosion is unknown. The underdrain that was provided for the spillway slab appears to be functioning as originally intended. The outlet of the drain was observed (see Photo 6) and water was dripping from it. The spillway was unobstructed and appears to be able to function properly.

(2) Emergency Spillway

The spillway channel is covered by a well maintained grass cover; however, the cover does not appear to be adequate protection against erosion. A large dish-shaped erosional scarp was observed in the spillway channel (see Photo 8). The scarp was about 2.5 feet deep and was located at about the axis of the dam embankment. Beyond the large scarp, a small channel was cut by the erosion that followed the left side of the spillway channel and was cutting into the left abutment. The erosion which is cutting into

the left abutment does not appear to affect the safety of the dam or abutment. If allowed to continue, the erosion will just continue to erode into the gently sloping abutment. The spillway is unobstructed and appears to function properly. No instabilities of the side slopes except for the erosion of the left side were apparent.

(3) Outlet Works

The outlet works provided for this dam are, reportedly, operable and the pumps associated with the system were operating on the day of the inspection.

e. Reservoir Area

The water surface elevation was 682.8 feet above M.S.L. on the day of inspection. The surface area of the reservoir at the normal water level is about 9 acres. The right reservoir rim is generally flat pasture land with an access road bordering the reservoir. The left rim area is mildly sloping pasture and farm land. No instabilities of the rim were observed. No houses are built near the reservoir, however, one house appeared to be located in the floodplain upstream of the reservoir (see Photo 12).

f. Downstream Channel

There is essentially no downstream channel for this dam since both spillways discharge directly into the lower reservoir (see Photos 5 and 9).

3.2 Evaluation

The following items were observed during the visual inspection that could affect the safety of the dam and spillways and which will require maintenance within a reasonable period of time.

1. The erosion on the upstream and downstream slopes due to wave action does not appear to affect the stability of the dam in its present condition. However, continual erosion can only be detrimental to the stability of the dam.

2. The erosion on the right abutment and embankment areas adjacent to the principal spillway could jeopardize the safety of the dam, abutment, and the normal operation of the principal spillway.

3. The trees and bushes observed on the embankment pose a potential danger to the safety of the dam. Depending upon the extent of the root system, the roots of large trees present possible paths for piping through the embankment. The root systems can also do damage to the embankment from being uprooted by a storm.

4. The joint displacements and minor deterioration of the concrete observed in the principal spillway do not appear to affect the structural integrity of the spillway in their present condition. Nevertheless, with time these conditions could worsen to the point where the safety of the spillway could be jeopardized.

5. The erosion of the backfill from the downstream end of the principal spillway and from behind of the left retaining wall, if allowed to continue, could endanger the stability of the spillway slab and the retaining wall.

6. The erosion in the emergency spillway can only worsen with future flows through the spillway because of the type of soil in the spillway and because of the exposed areas of the scarp.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

There are no specific procedures that are followed for the operation of the lake and the dam. When water is needed for the treatment purpose, water is pumped from the reservoir to the treatment plant.

4.2 Maintenance of Dam

The dam and appurtenant structures are maintained by workmen employed by the Perry Water and Light Department. The crest and slopes are mowed periodically. However, a few trees and bushes were observed growing on the embankment, which pose a potential danger to the safety of the dam. The maintenance of the dam is thus considered inadequate.

4.3 Maintenance of Operating Facilities

The only operable facilities associated with the dam are the valves and piping which direct water from the reservoir to the treatment plant and the lower reservoir. These facilities are also maintained by the workmen employed with the Perry Water and Light Department.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any warning system in use at the damsite.

4.5 Evaluation

The maintenance at Perry City Dam No. 2 appears to be inadequate. The remedial measures described in Section 7 should be undertaken to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

No hydrologic and hydraulic design data are available for Perry City Dam No. 2. The sizes of physical features utilized to develop the stage-outflow relation for the spillways and overtopping of the dam were prepared from field notes and sketches prepared during the field inspection and available drawings. The reservoir elevation-area data were based on the U.S.G.S. Perry, Missouri Quadrangle topographic map (7.5 minute series). The spillway and overtop release rates and the reservoir elevation-area data are presented in Appendix B.

The hydrologic soil group of the watershed was determined from information available in the U.S.D.A. Soil Conservation Service publication "Missouri General Soil Map and Soil Association Descriptions", 1979. The Probable Maximum Precipitation (PMP) used to determine the Probable Maximum Flood (PMF) was determined by using the U.S. Weather Bureau publication, "Hydrometeorological Report No. 33" (April 1956). The 100-year and the 10-year floods were derived from the 100-year rainfall and the 10-year rainfall, respectively, of Hannibal, Missouri.

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this site. However, according to Mr. Elliot, Water Superintendent of Perry Public Utilities, the maximum reservoir level was about 3 feet above the crest of the principal spillway.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1d and evaluated in Section 3.2.

d. Overtopping Potential

Both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The peak inflows of the PMF and one-half of the PMF are 12,580 cfs and 6,290 cfs, respectively. The peak outflow discharges for the PMF and the one-half of the PMF are 12,489 and 6,225 cfs, respectively. The maximum capacity of the spillways just before overtopping the dam is 3,139 cfs. The PMF overtopped the dam by 2.15 feet and the half PMF by 0.82 feet. The total duration of flow over the dam is 5 hours during the PMF and 1.75 hours during the one-half PMF. The dam may be susceptible to erosion due to the high velocity of flow on its downstream slope, due to overtopping of the dam. The reservoir/spillway system of Perry City Dam No. 2 is capable of accommodating a flood equal to approximately 25 percent of the PMF just before overtopping the dam. The reservoir/spillway system of Perry City Dam No. 2 will not accommodate the one-percent chance flood without overtopping; however, it will accommodate the ten-percent chance flood without overtopping the dam.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately four miles downstream of the dam. Within the damage zone there are three dwellings, a trailer, and a dam (Mo. 10675) located immediately below this dam.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement observed on the embankment during the visual inspection. There were no signs of distress on the embankment other than the erosion due to wave action on the slopes and erosion in the area of the principal spillway due to discharges through the spillway. The exposed portions of the dam are protected by grass. The trees growing on the lower slopes could eventually pose a hazard to the embankment. Neither the upstream nor the downstream slopes, nor the emergency spillway channel, have a protective riprap layer and, consequently, they have been eroded. In the absence of seepage and stability analyses, no quantitative evaluation of the structural stability can be made.

The structural stability of the principal spillway appeared to be questionable due to the joint displacements observed in the spillway channel. However, it is felt that the joint displacements do not constitute an unsafe condition at this time. The emergency spillway appeared to be structurally stable with the exception of the erosion. Both spillways were unobstructed and appeared to be able to function properly.

b. Design and Construction Data

The design drawings were of limited use in the assessment of the structural stability of the dam and appurtenant structures, even though the dam and appurtenant structures appeared to be constructed as shown on the drawings except for the discrepancies mentioned in Section 1.2a. Seepage and stability analyses compar-

able to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. No embankment or foundation soil parameters were available for carrying out a conventional stability analyses on the embankment. No construction data or specifications relating to the degree of embankment compaction were available for use in a stability analyses.

c. Operating Records

No operating records were available relating to the dam or appurtenant structures. The water level on the day of the visual inspection was approximately 2 inches below the crest of the principal spillway. The normal operating level is considered to be at the crest of the principal spillway; however, the water has apparently been three feet above the principal spillway crest at its highest point.

d. Post Construction Changes

No post construction changes to the embankment are known to exist that will affect the structural stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 1, as defined in "Recommended Guidelines for Safety Inspection of Dams" prepared by the Corps of Engineers, and will not require a seismic stability analysis. An earthquake of the magnitude that would be expected in a Seismic Zone 1 will not cause distress to a well designed and constructed earth dam. Available literature indicates that no active faults exist near the vicinity of the damsite.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of inspection along with data available to the inspection team. It is also important to note that the condition of a dam depends upon numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Perry City Dam No. 2 is found to be "Seriously Inadequate". The reservoir/spillway system will accommodate approximately 25 percent of the PMF without overtopping the dam. The surface soils in the embankment and the emergency spillway appears to be clayey silt. The emergency spillway and the dam embankment have a cover of grass. The dam is overtopped by 2.14 feet during the occurrence of the PMF. The maximum velocity of flow in the emergency spillway during the PMF will be about 9 ft/sec. The emergency spillway channel may be subject to erosion due to high velocity of flow during the PMF. The dam may also be susceptible to erosion due to high velocity of flow on its downstream slope, due to overtopping of the dam during the PMF.

The dam appears to be in generally good condition. A quantitative evaluation of the safety of the embankment could not be made in view of the absence of seepage and stability analyses. The present embankment and appurtenant structures, however, reportedly have performed satisfactorily since their construction; there have been no failures or evidence of instability. Reportedly, the dam has never been overtopped and no evidence indicating the contrary was observed. The safety of the dam can be improved if the deficiencies described in Sections 3.2 and 6.1a are properly corrected as described in Section 7.2.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurement, design drawings, past performance, and the present condition of the dam. Information on the design hydrology, hydraulic design, operation, and maintenance of the dam were not available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time, and the item recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based upon results of the Phase I inspection, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

One of the following mitigation measures should be undertaken under the direction of an engineer experienced in the design and construction of earth dams to avoid severe consequences of dam failure from overtopping.

1. Increase the spillway capacity to pass the Probable Maximum Flood without overtopping the dam.

2. Increase the height of the dam enough to pass the PMF without overtopping the dam. An investigation should be done that also includes studying the effects on the structural stability of the existing embankment. The overtopping depth during the occurrence of the PMF, stated in Section 5.1d, is not the required or recommended increase in the height of the dam.

3. A combination of 1 and 2 above.

4. Provide a highly reliable flood warning system (generally does not prevent damage but avoids loss of life).

b. O & M Procedures

1. The erosion due to wave action on the upstream and downstream slopes should be properly repaired and adequately protected to prevent further erosion.

2. The areas of the erosion on the right abutment and embankment and in the principal spillway area should be stabilized and protected from further damage.

3. The trees and bushes on the embankment should be removed from the embankment and prevented from regrowth. Removal of large trees should be under the guidance of an engineer experienced in the design and construction of earth dams.

4. Monitor the joint displacements and the minor deterioration of the concrete in the principal spillway and make corrective repairs when deemed necessary.

5. The erosion of the backfill from the downstream end of the principal spillway and from behind the left retaining wall should be properly backfilled and the areas properly protected from further damage.

6. The erosion in the emergency spillway should be properly repaired and the channel properly protected from further erosion.

7. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

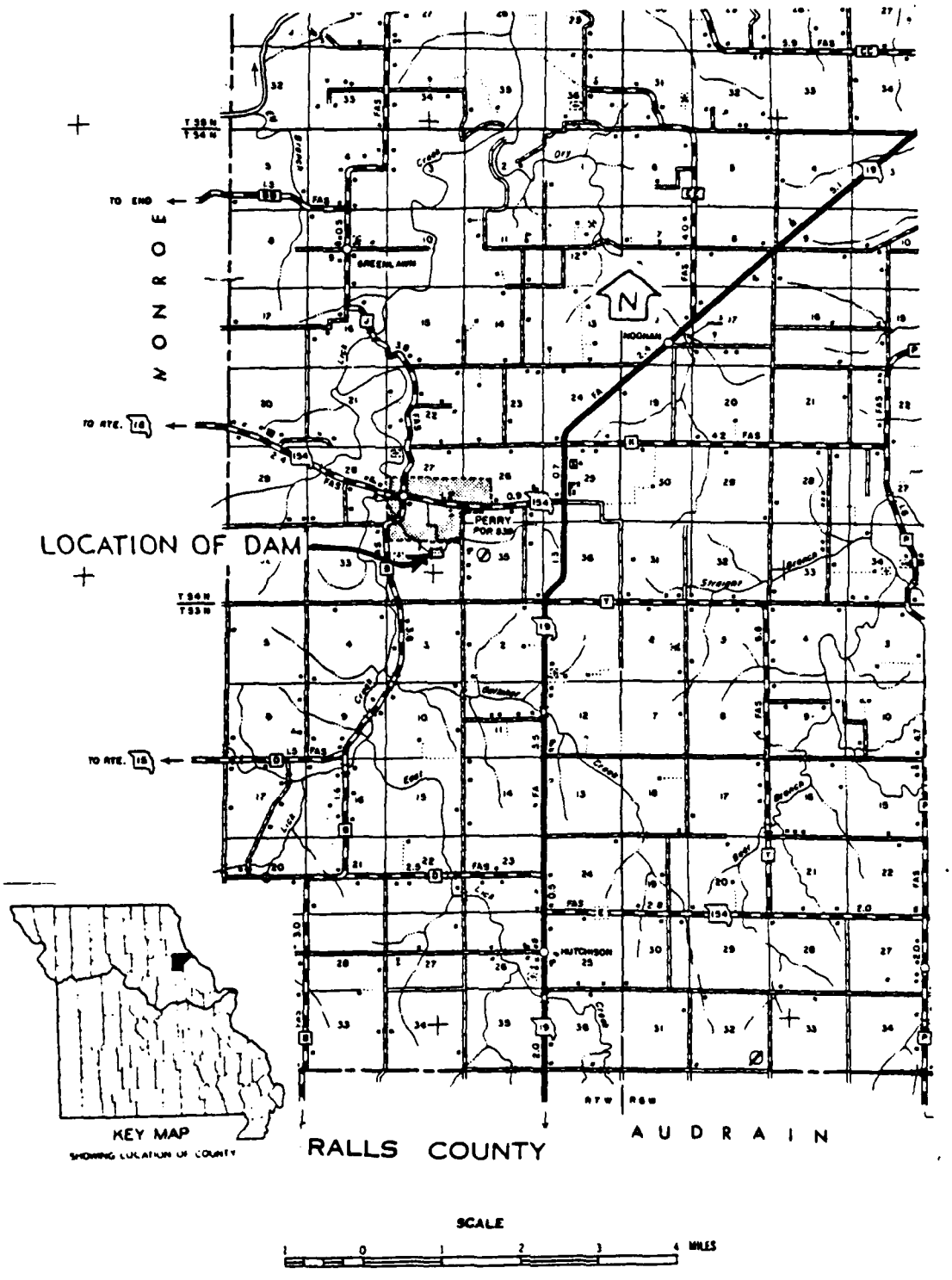
8. The owner should initiate the following programs:

   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earth dams.

   (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

PLATES

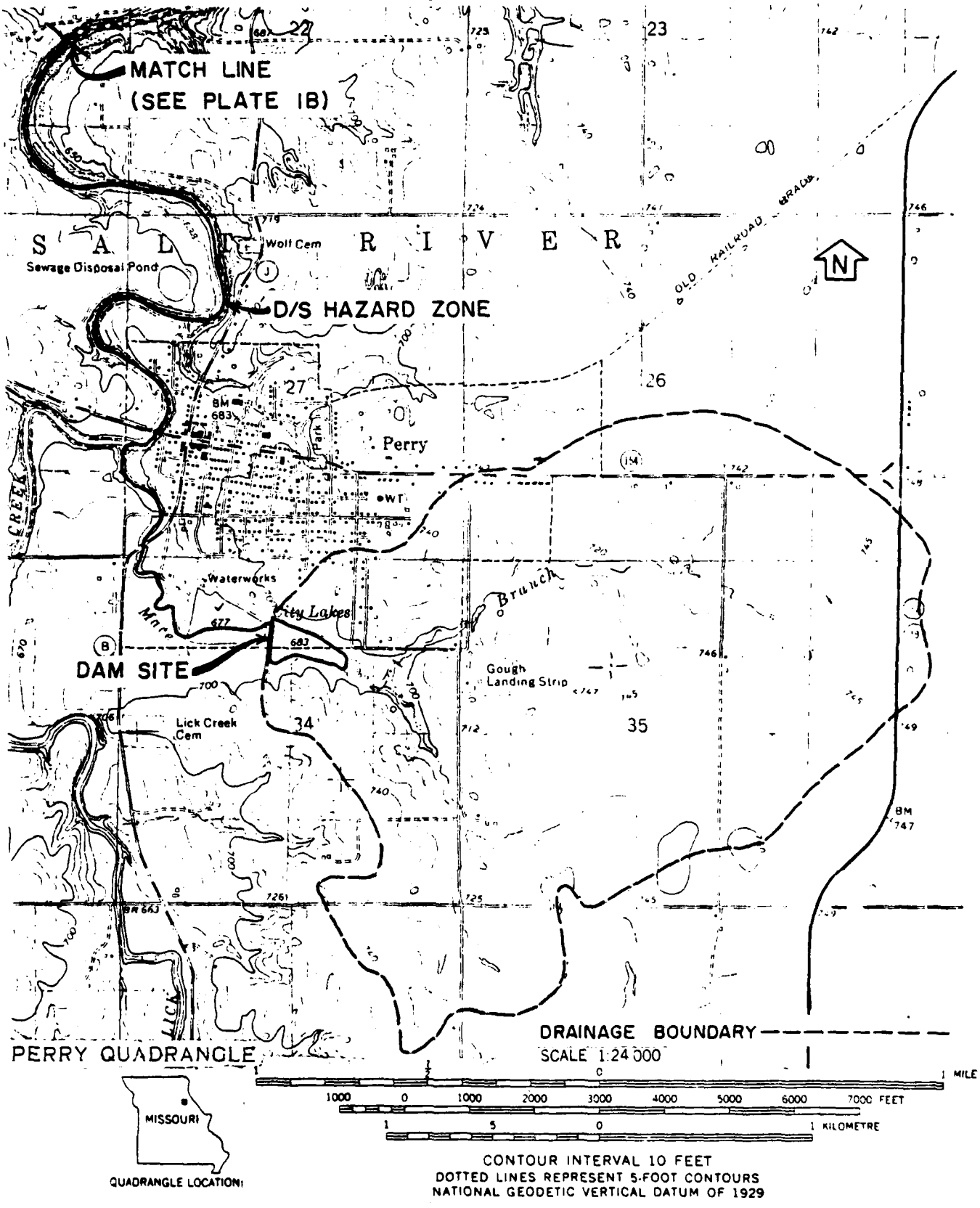
PLATE 1



LOCATION MAP - PERRY CITY DAM II

MO. 10980

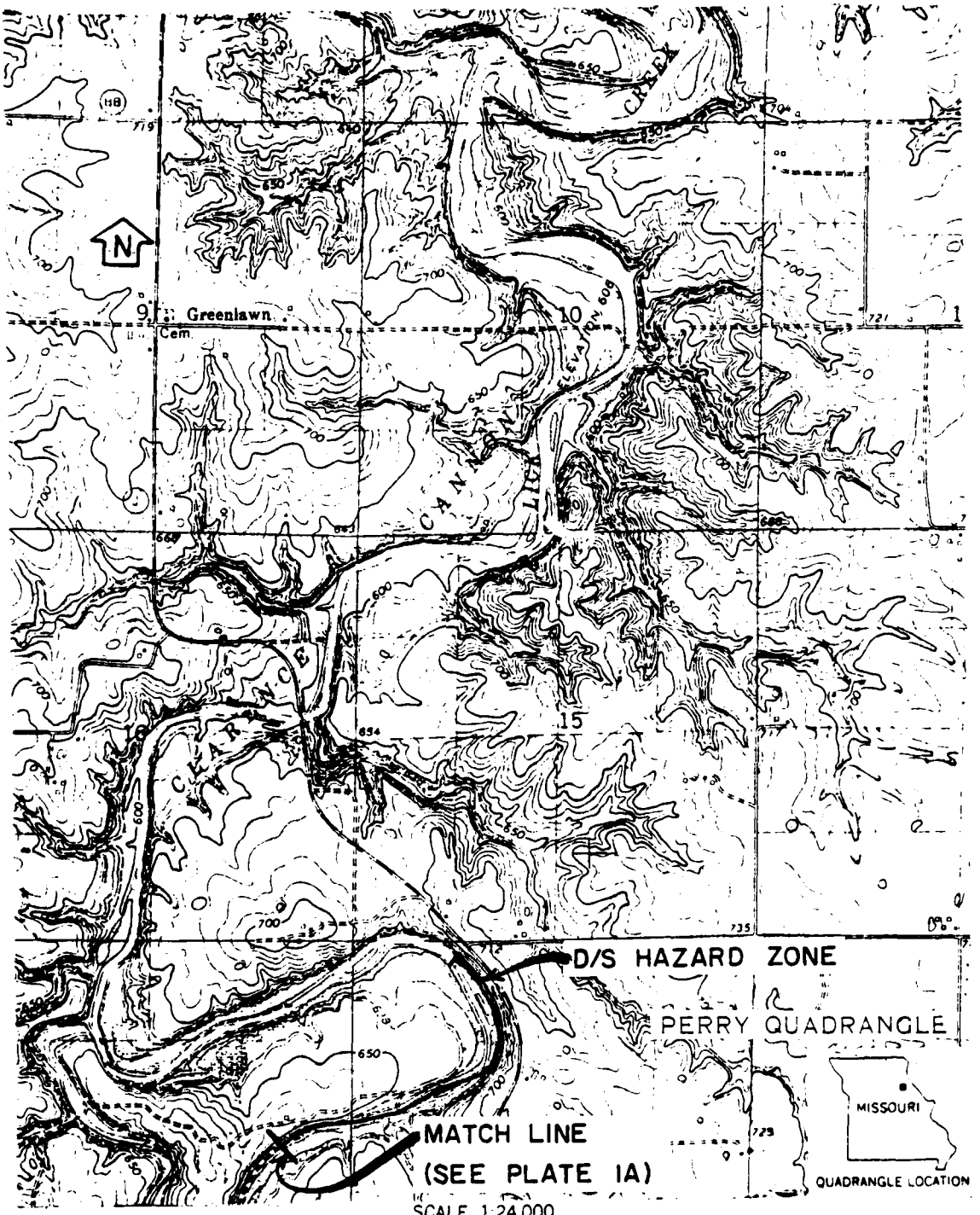
PLATE 1A



CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

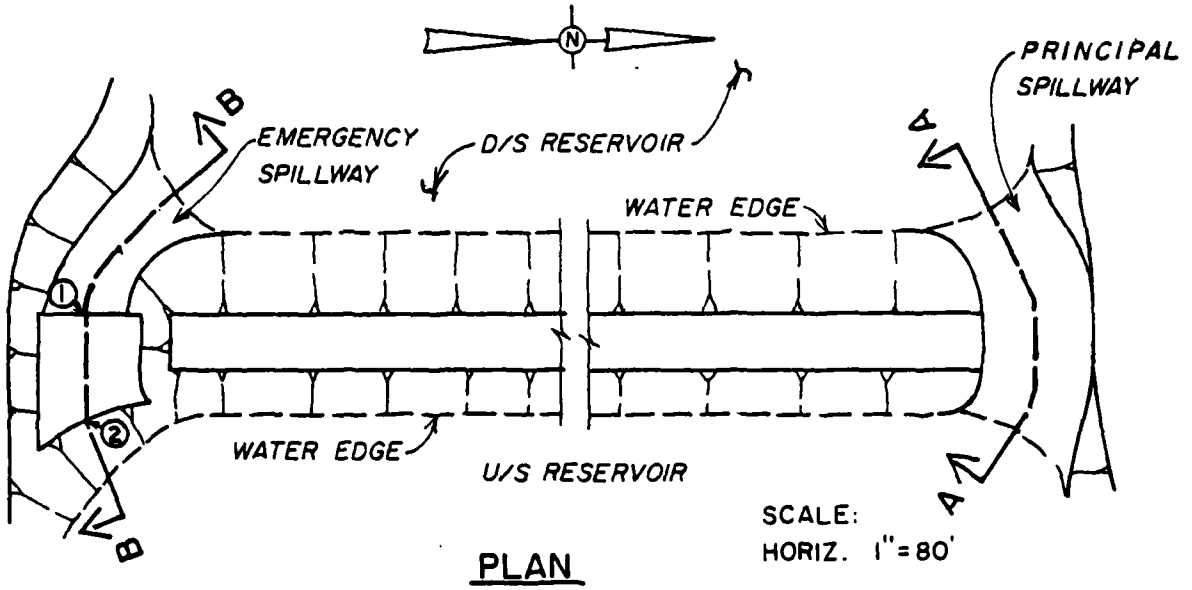
PERRY CITY DAM NO. 2 (MO. 10980)
DRAINAGE BASIN AND DOWNSTREAM HAZARD ZONE

PLATE 1B



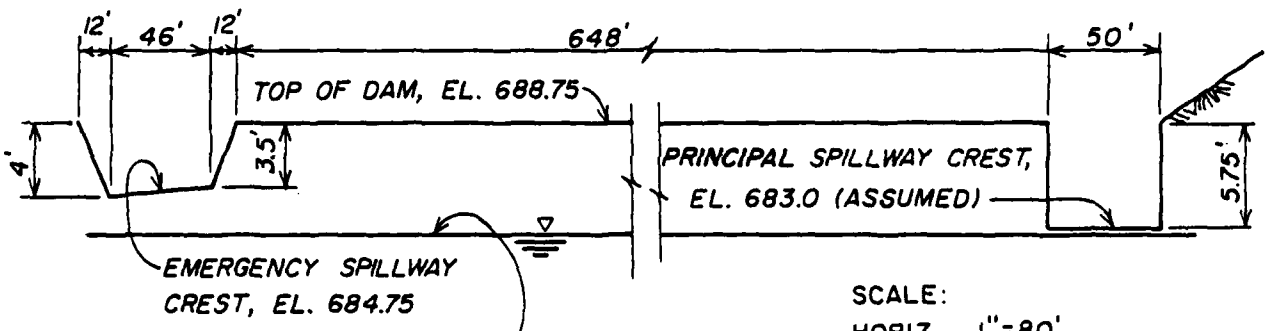
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

PERRY CITY DAM NO. 2 (MO. 10980)
DRAINAGE BASIN AND
DOWNSTREAM HAZARD ZONE (CONT.)



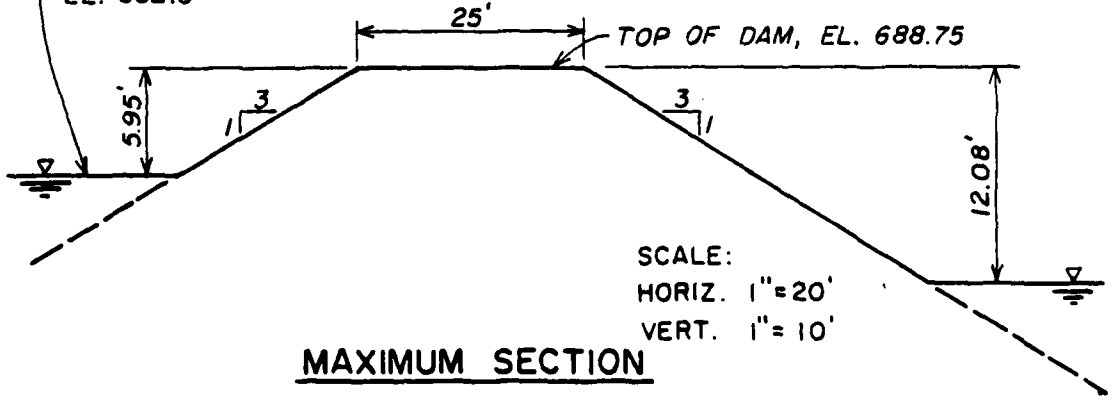
SCALE:
HORIZ. 1"=80'

PLAN



ELEVATION

SCALE:
HORIZ. 1"=80'
VERT. 1"=10'

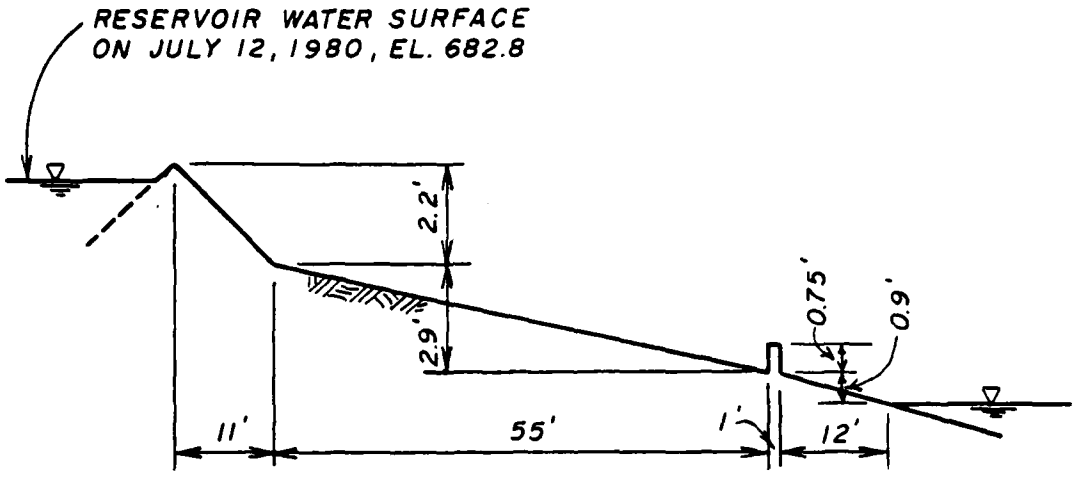


SCALE:
HORIZ. 1"=20'
VERT. 1"=10'

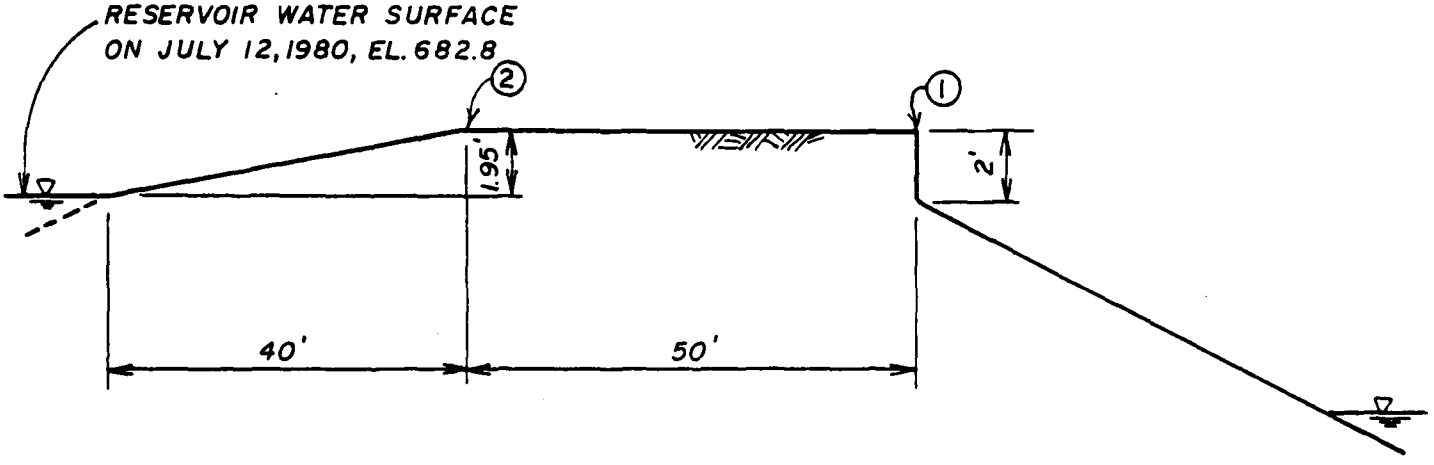
MAXIMUM SECTION

NOTE: ALL ELEVATIONS ARE SHOWN AS FEET ABOVE M.S.L.

PERRY CITY DAM NO. 2 (MO. 10980)
PLAN, ELEVATION &
MAXIMUM SECTION OF EMBANKMENT



SECTION A-A
PRINCIPAL SPILLWAY



SECTION B-B
EMERGENCY SPILLWAY

SCALE:
HORIZ. 1" = 20'
VERT. 1" = 5'

PERRY CITY DAM NO. 2 (MO. 10980)
SECTION A-A AND B-B

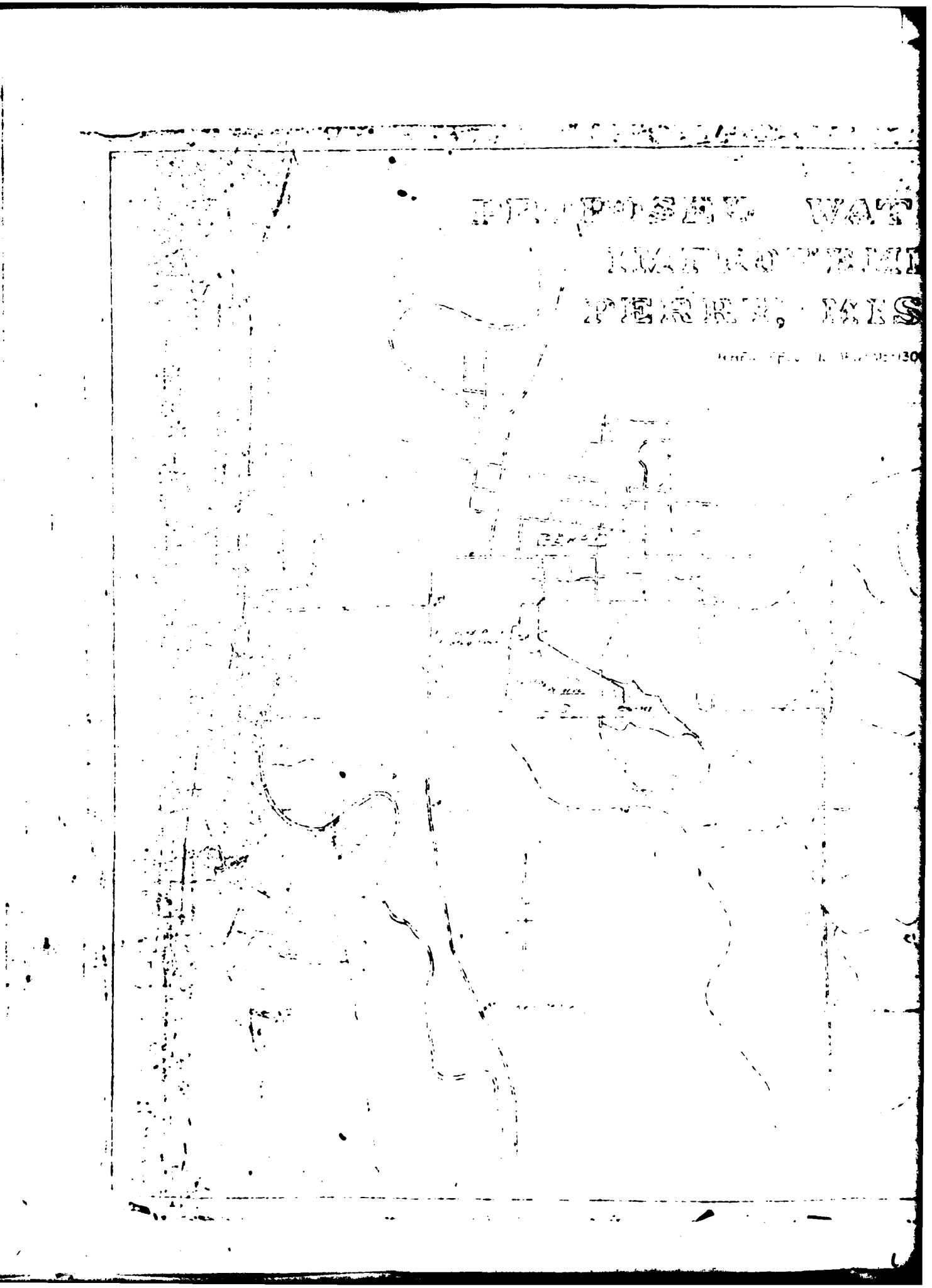
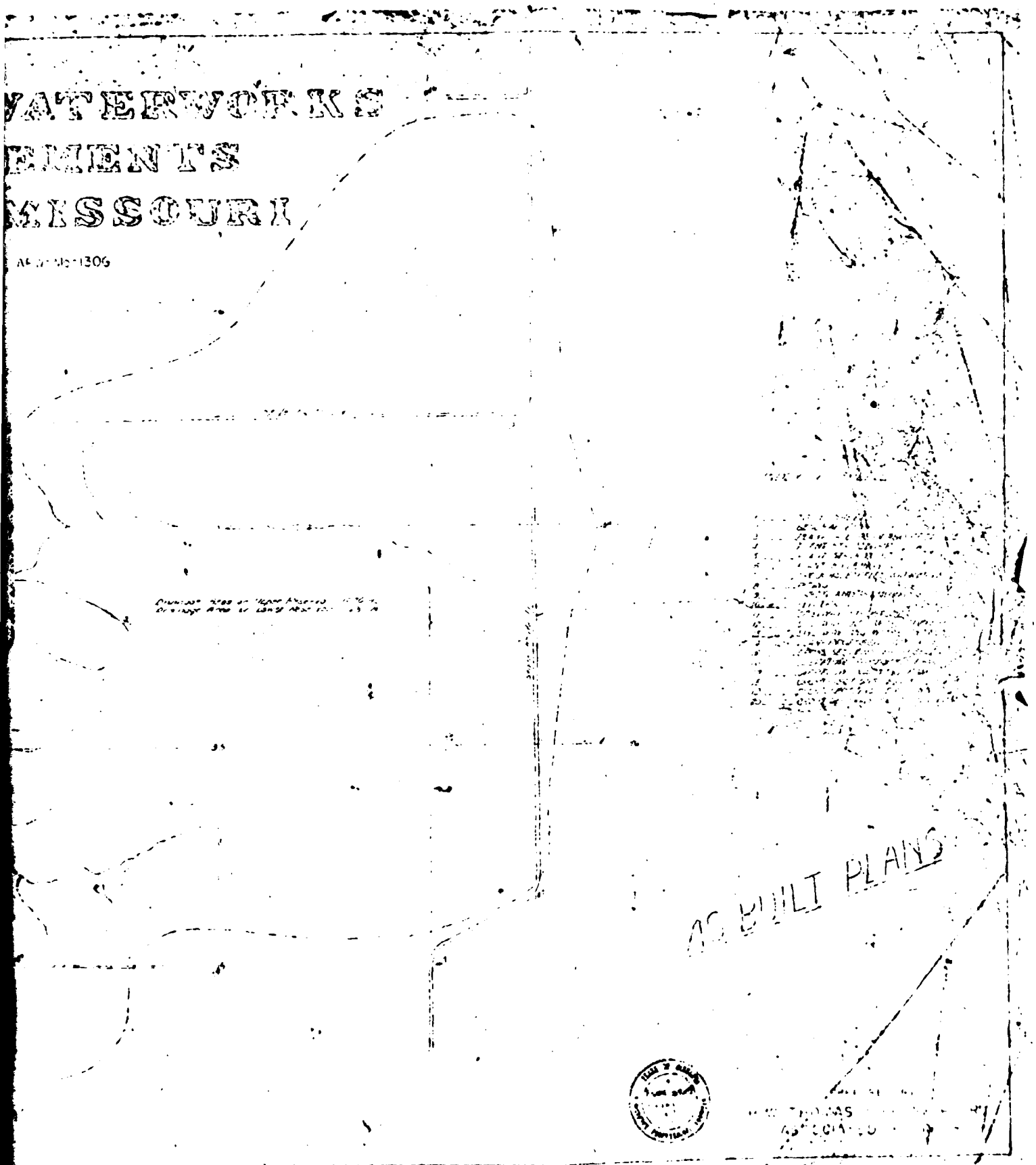


PLATE-4



12

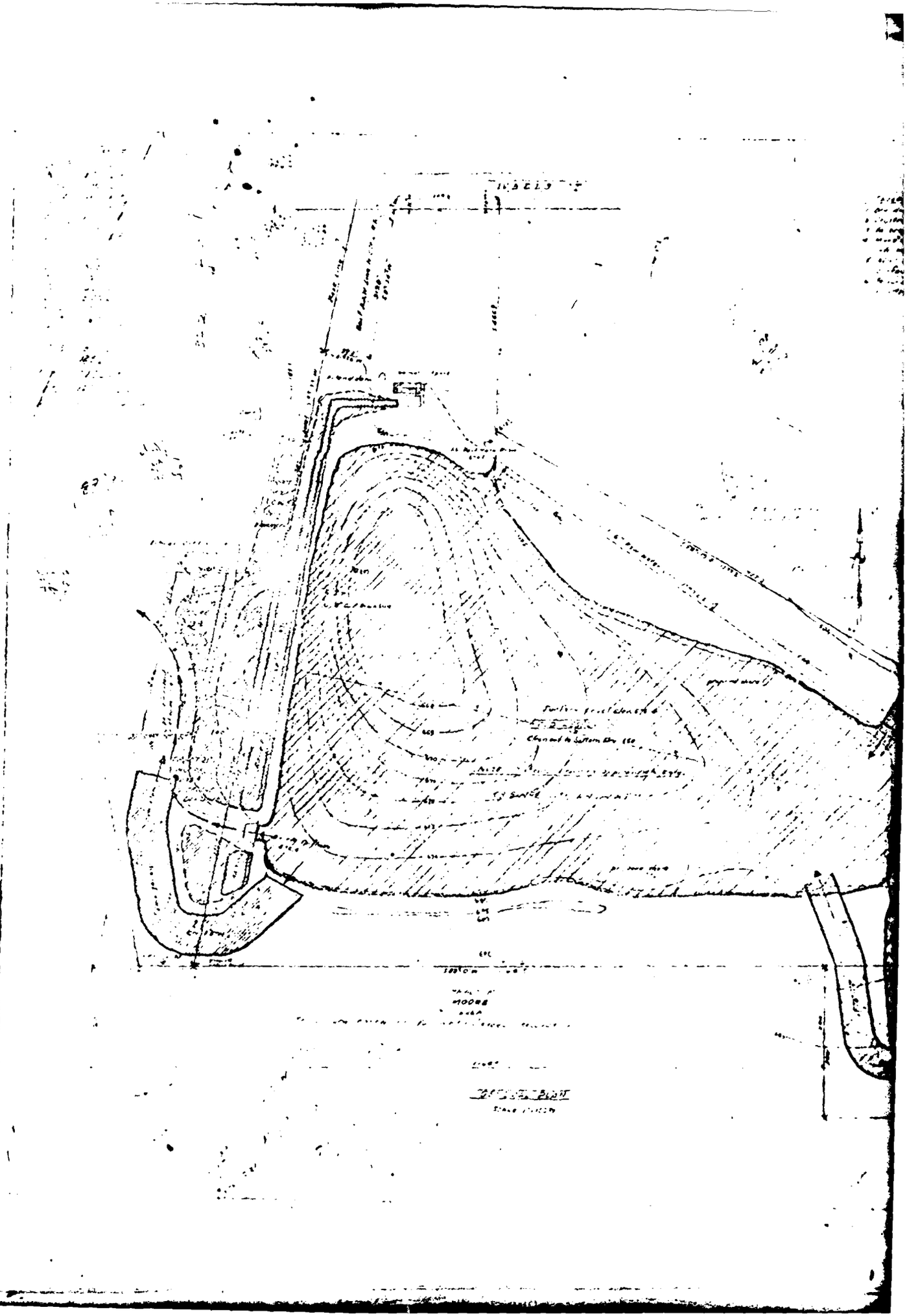
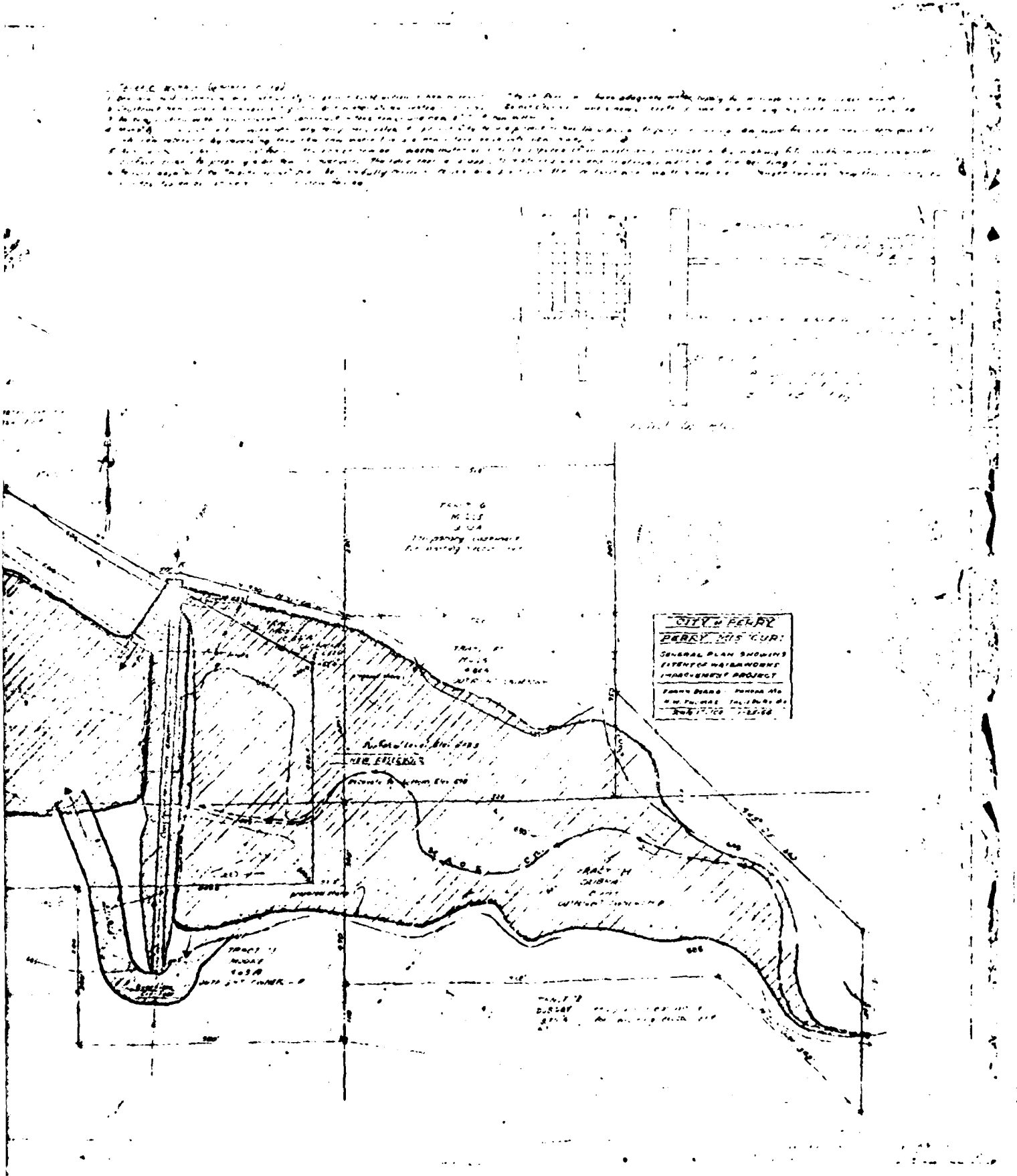


PLATE-5


CITY OF FERRY
FERRY MISSOURI
GENERAL PLAN SHOWING
EXTENT OF HARBORWORKS
IMPROVEMENT PROJECT

12

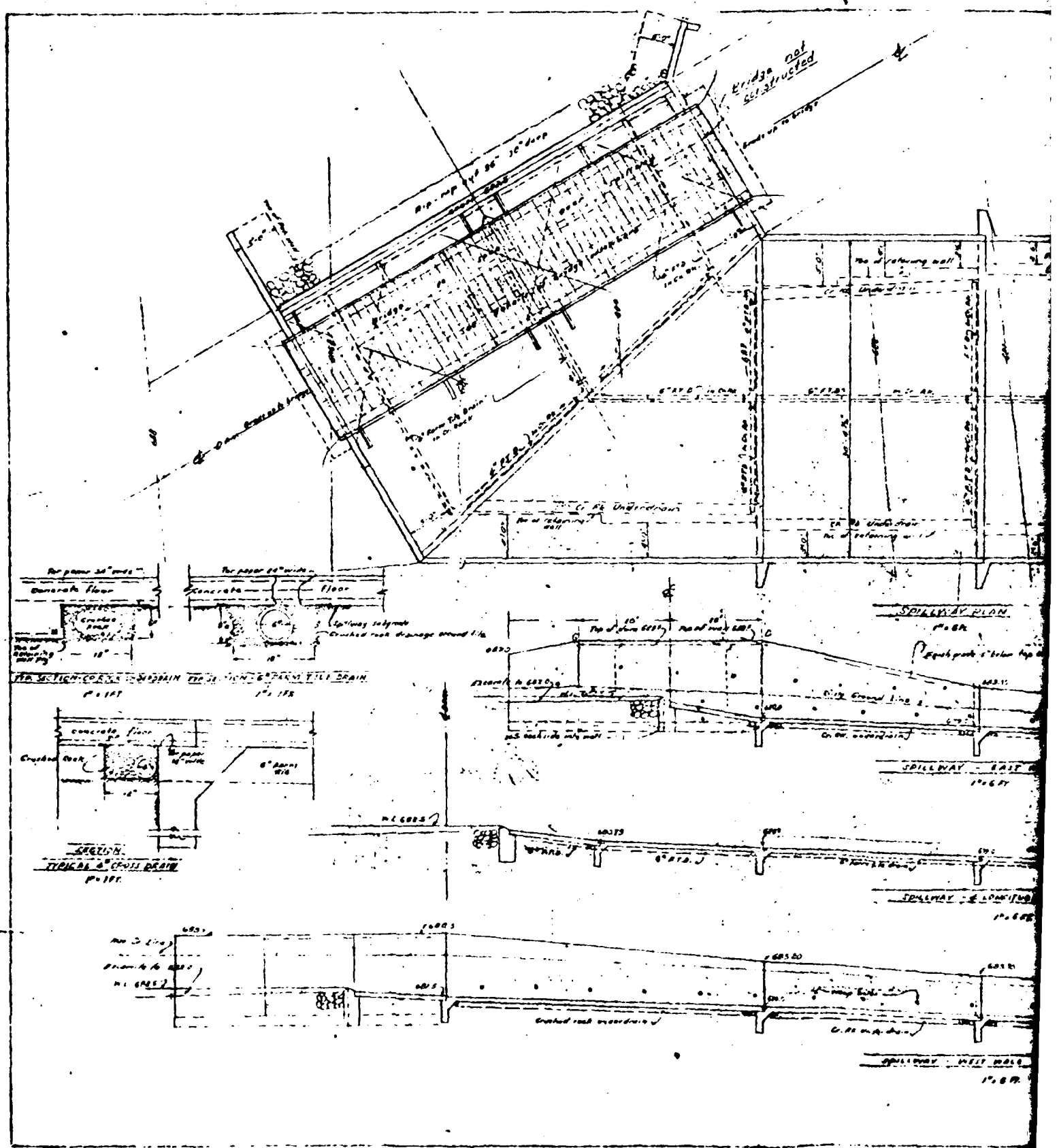
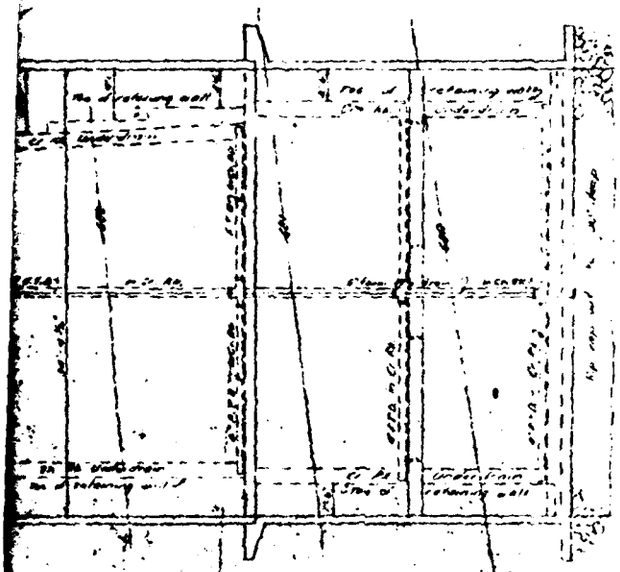
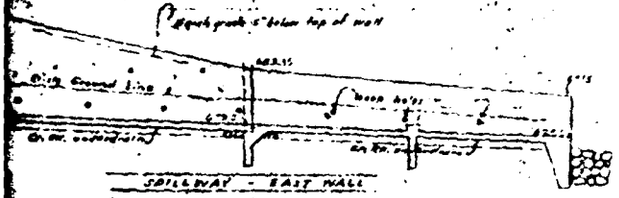

Bridge not constructed
SPILLWAY PLAN
SECTION
TYPICAL 6" CROSS DRAIN
SPILLWAY - EAST
SPILLWAY - WEST WALL

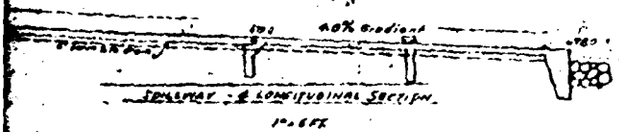
PLATE-6



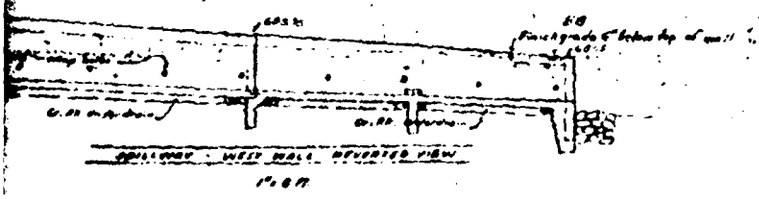
SPILLWAY PLAN



SPILLWAY - EAST WALL



SPILLWAY - E LONGITUDINAL SECTION



SPILLWAY - WEST WALL DEVELOPED VIEW

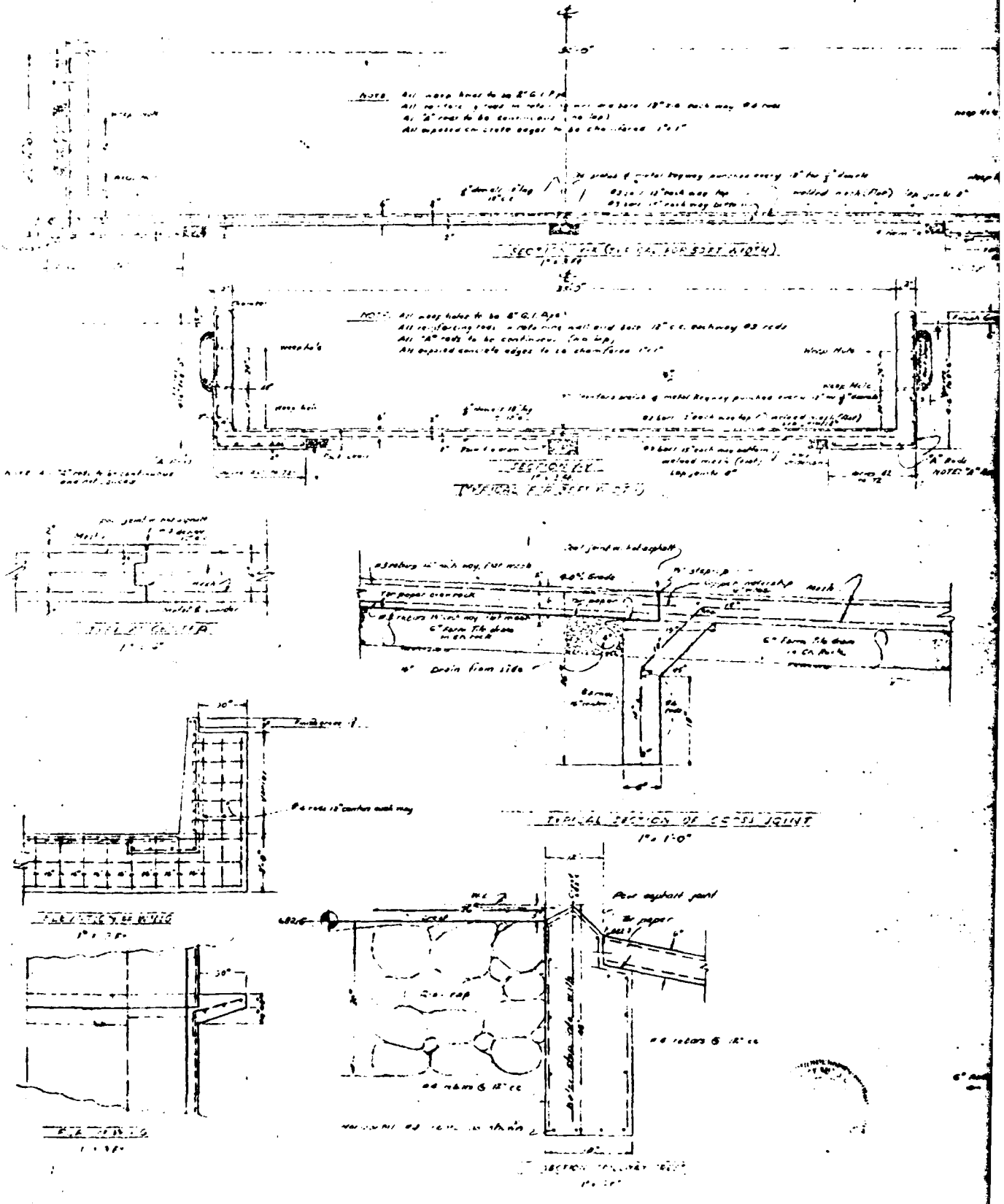
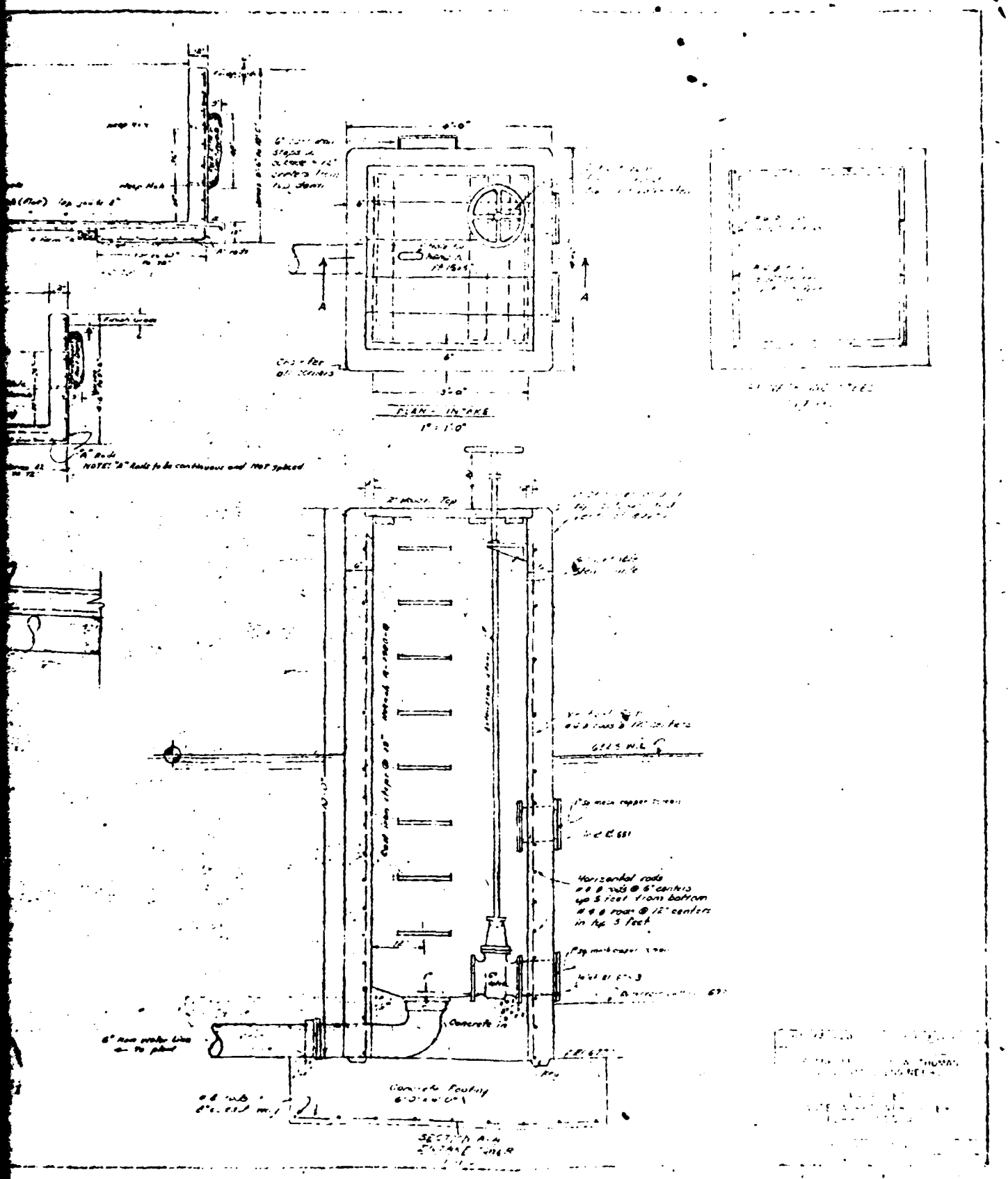
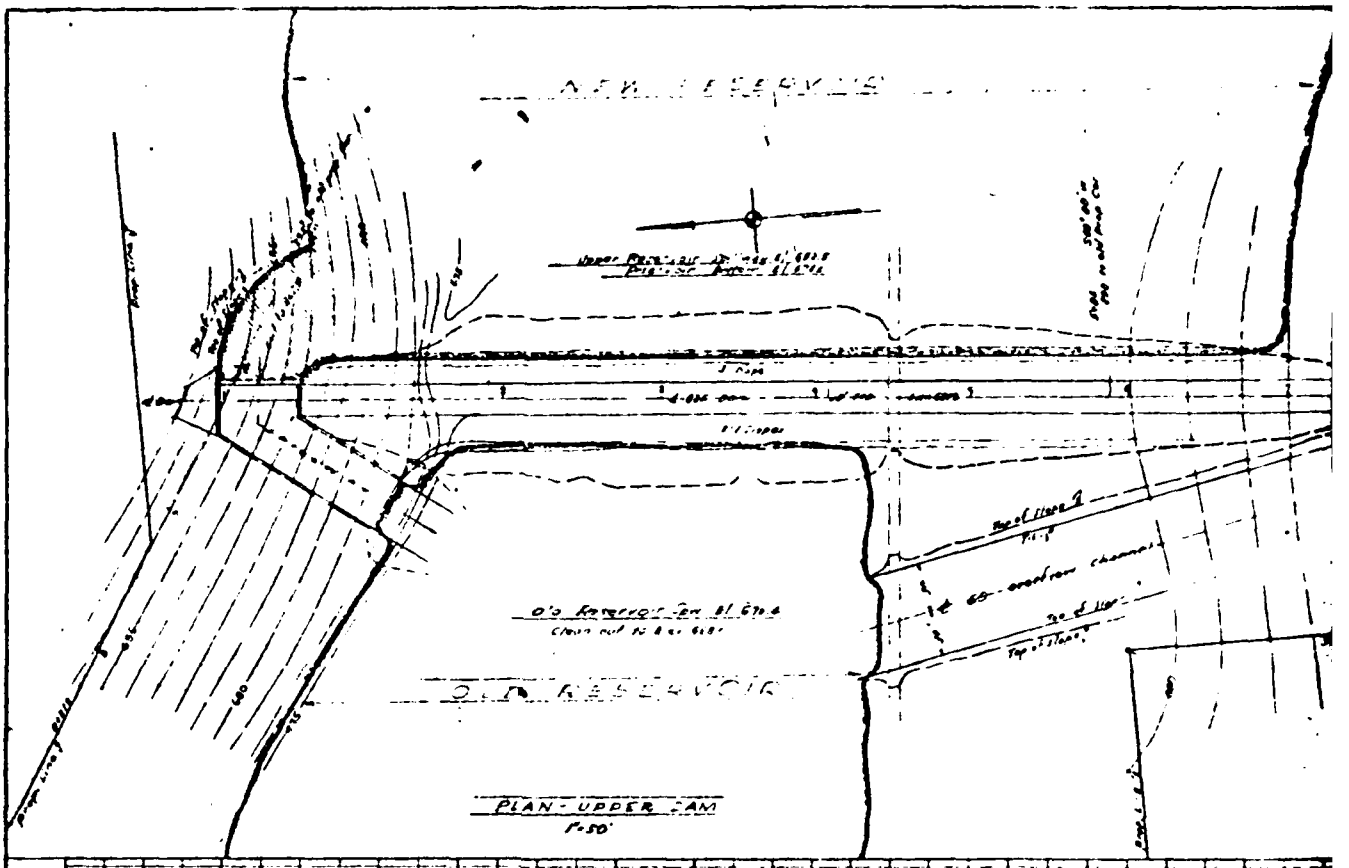
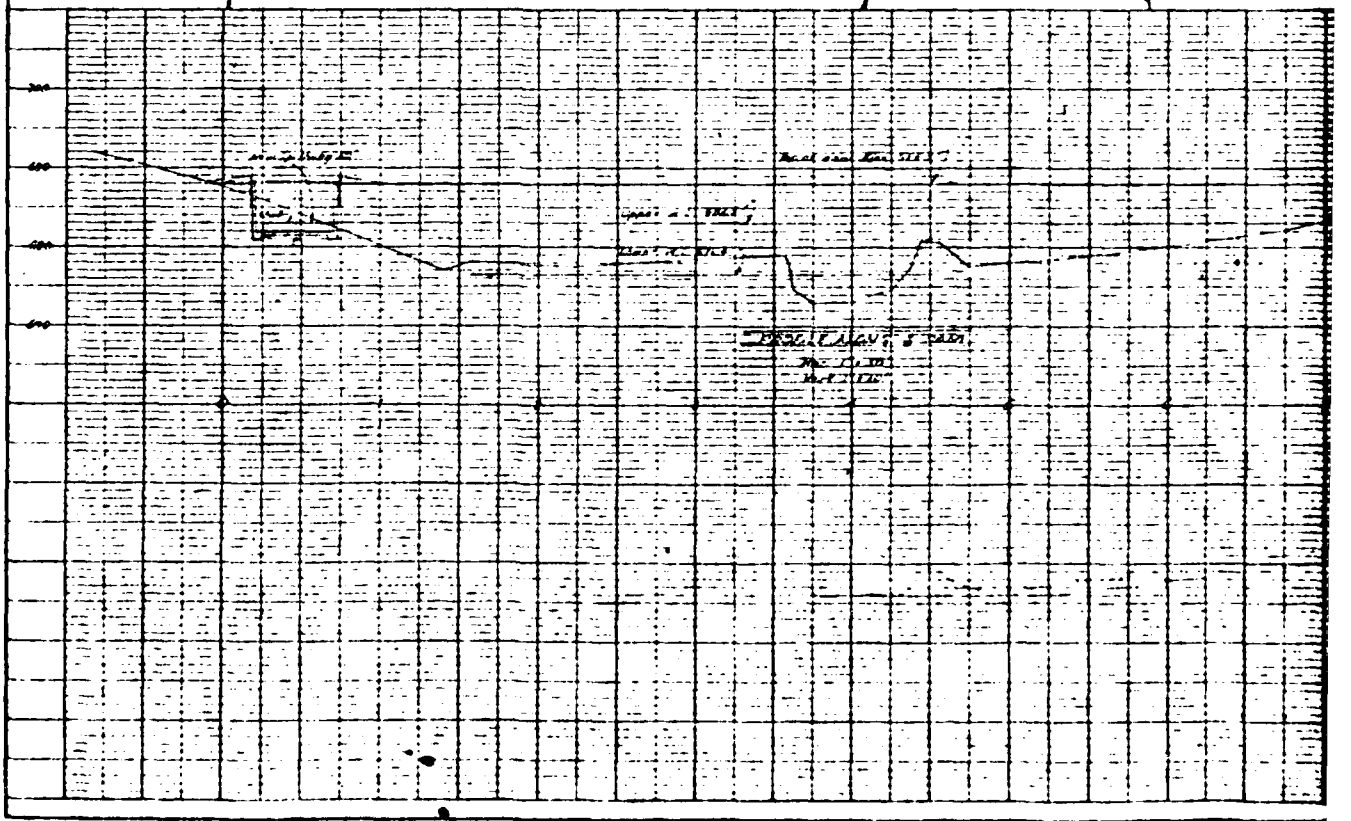


PLATE-7


PLAN - INTAKE
1" = 1'-0"
NOTE: "A" bars to be continuous and not spliced
Horizontal rods
Concrete Footing
SECTION A-A

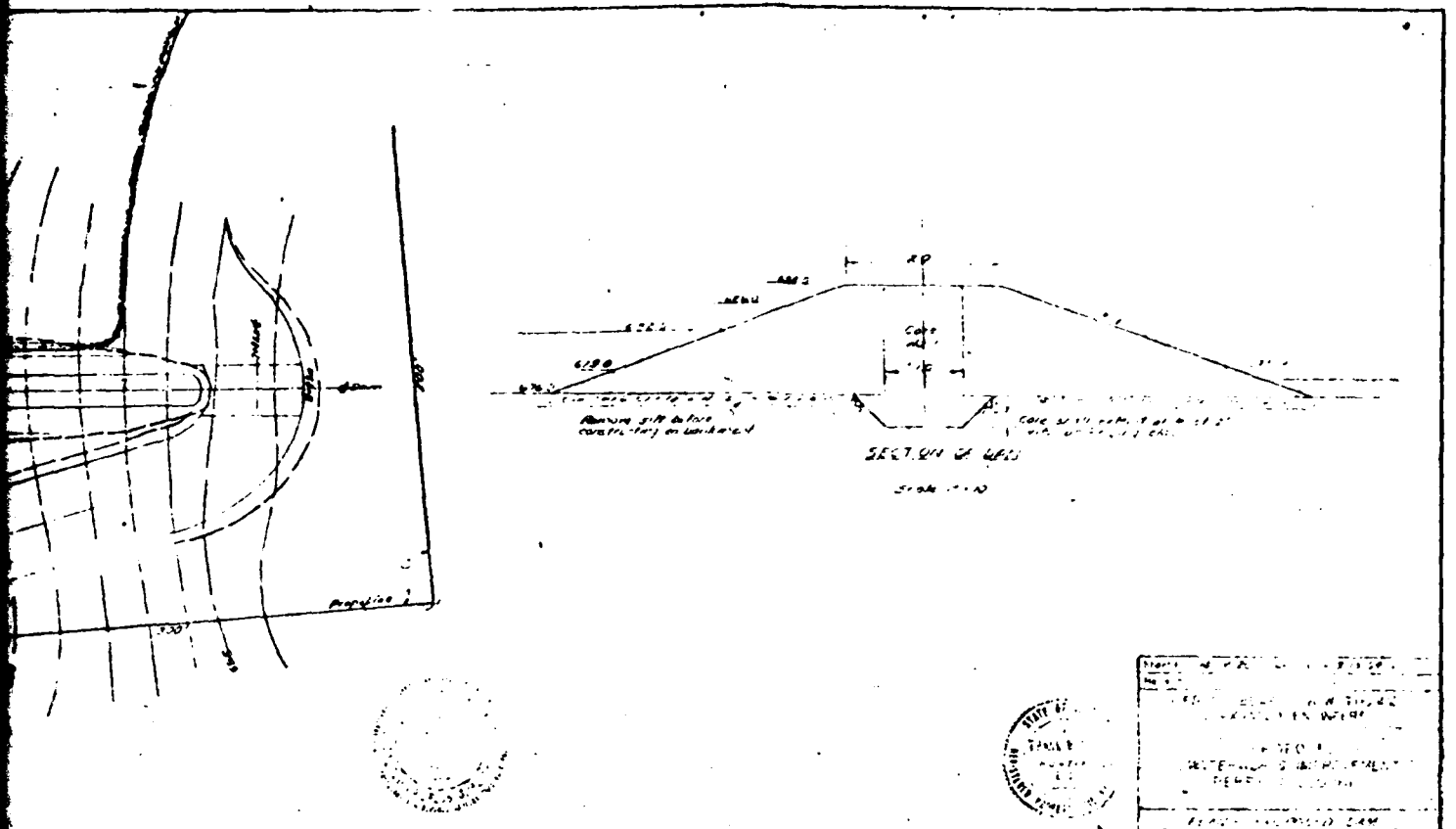
12

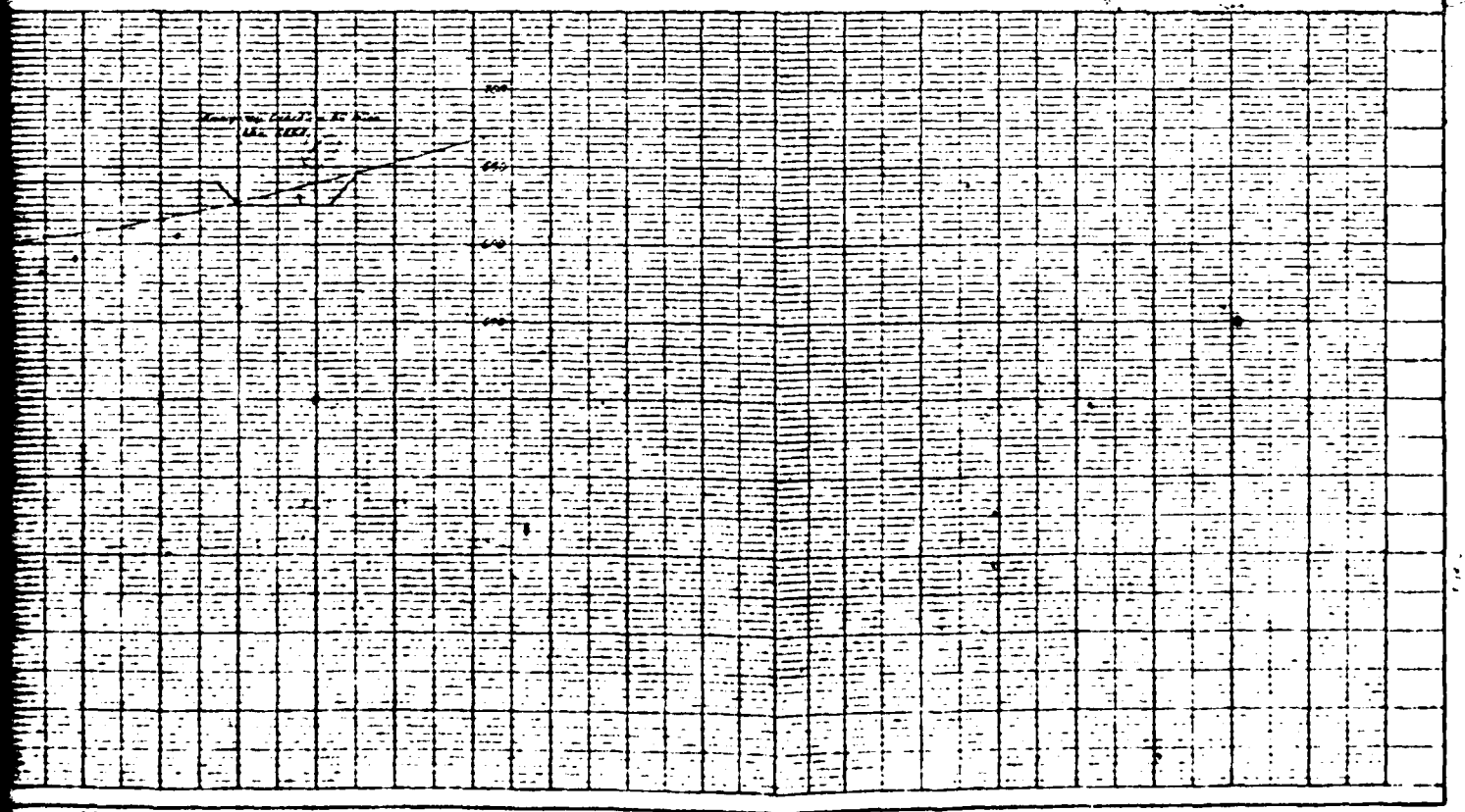




K·E

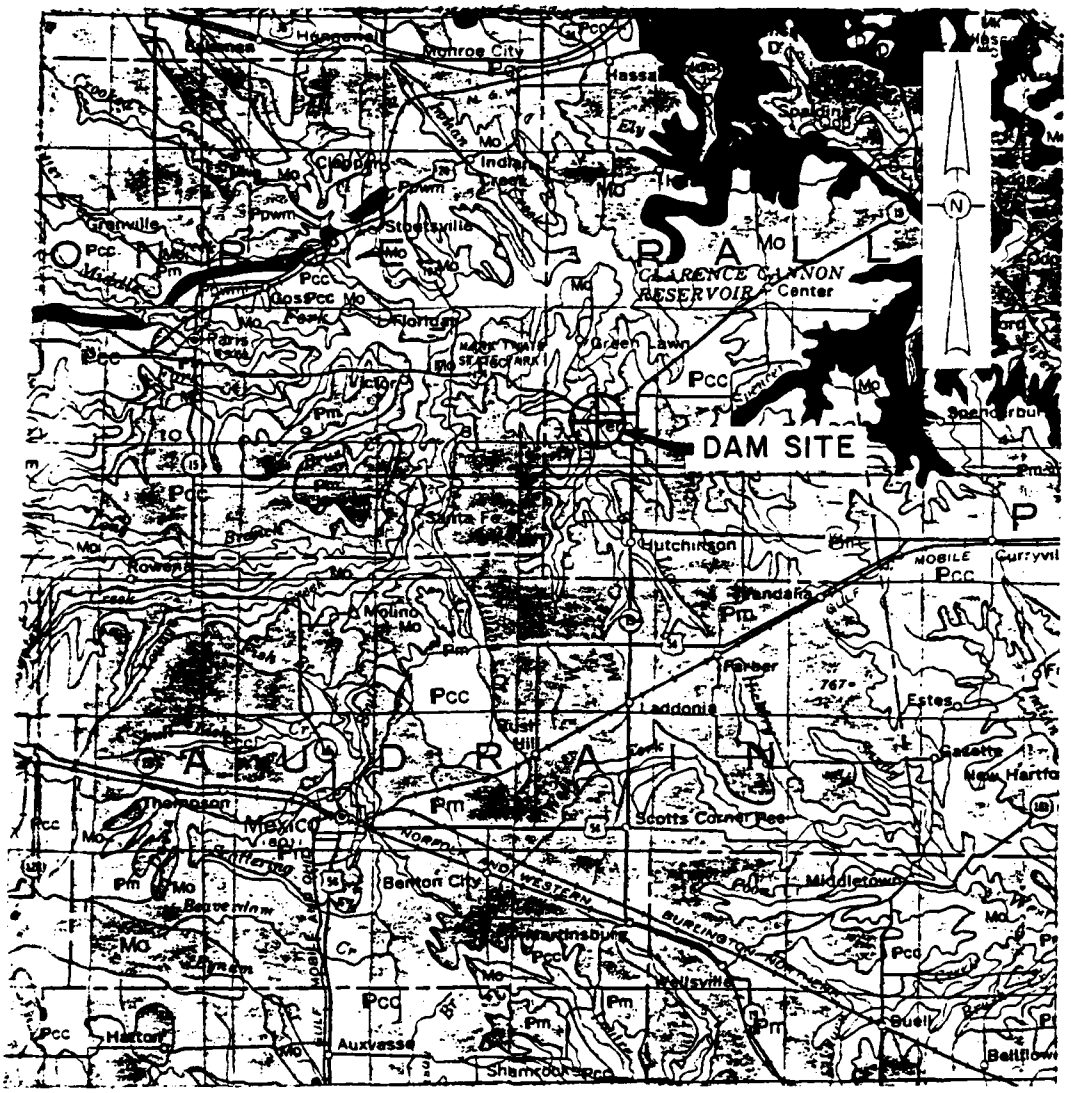
PLATE-8





K·E

PLATE 9



SCALE

10 0 10 20 30 40 Miles

⊕ LOCATION OF DAM

NOTE: LEGEND OF THIS DAM IS ON PLATE 10

REFERENCE:

GEOLOGIC MAP OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY
KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP OF PERRY CITY DAM NO. 2

PERRY CITY DAM NO. 2

PLATE 10

LEGEND

PERIOD	SYMBOL	DESCRIPTION
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
PENNSYLVANIAN	PPwm	PLEASANTON GROUP: CYCLIC DEPOSITS OF SANDSTONE, SHALE AND LIMESTONE
	Pm	MARMATON GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
	Pcc	CHEROKEE GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
MISSISSIPPIAN	Mo	KEOKUK - BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	Mk	CHOUTEAU GROUP: BACHELOR AND HANNIBAL FORMATION (LIMESTONE AND SHALE)
DEVONIAN	D	SULPHUR SPRING GROUP: BUSHBERG SANDSTONE, GLEN PARK LIMESTONE, GRASSY CREEK SHALE
ORDOVICIAN	Omk	MAQUOKETA SHALE, KIMMSWICK LIMESTONE
	Odp	DEKORAH FORMATION: GREEN TO GRAY CALCAREOUS SHALE WITH THIN FOSSILIFEROUS LIMESTONE

APPENDIX A

PHOTOGRAPHS

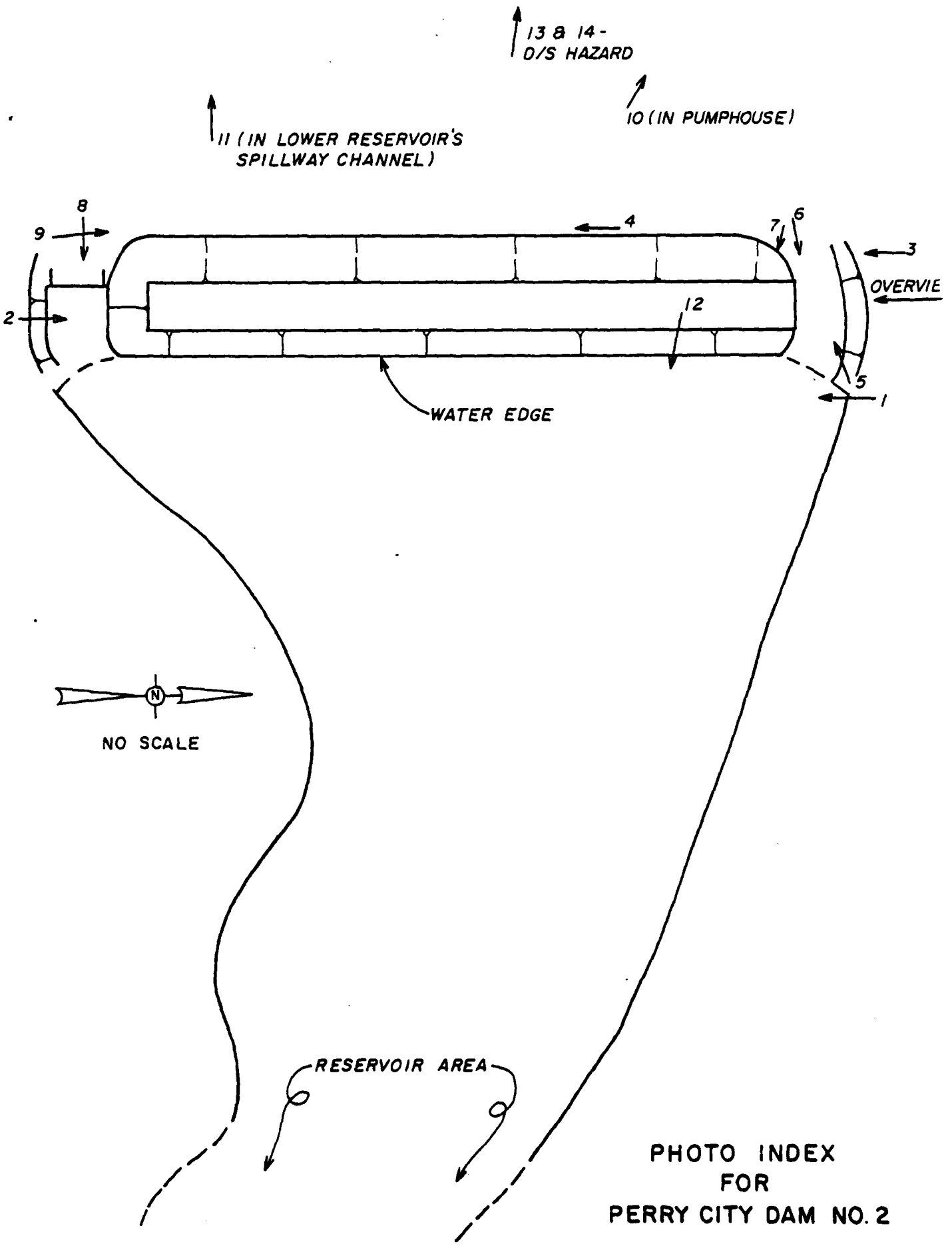


PHOTO INDEX
FOR
PERRY CITY DAM NO. 2

Perry City Lake Dam No. 2

Photographs

Photo 1 - View of the upstream slope showing the vegetative growth and the location of the concrete intake tower.

Photo 2 - View of the top of dam looking through the emergency spillway.

Photo 3 - View of the downstream slope showing the maintained grass cover on the upper portion of the slope and the trees and bushes at the toe.

Photo 4 - View of a scarp at the toe of the embankment due to wave erosion.

Photo 5 - View of the principal spillway looking towards the downstream reservoir.

Photo 6 - View of the downstream end of the chute spillway showing the eroded backfill at the downstream end and the 6-inch outlet of the slab underdrain.

Photo 7 - View showing the erosion of backfill from behind the downstream end of the left retaining wall of the principal spillway.

Photo 8 - View of the control section of the emergency spillway looking upstream and showing the large erosional scarp in the channel.

Photo 9 - View of the discharge channel of the emergency spillway.

Photo 10 - View of the two pumps located in the water treatment plant used to pump water out of the reservoir.

Photo 11 - View of the siltstone outcrop in the downstream channel of the downstream dam.

Photo 12 - View of the reservoir and rim.

Photo 13 - View of a dwelling downstream of the dam which appears to be in the downstream hazard zone.

Photo 14 - View of a dwelling downstream of the dam which appears to be in the downstream hazard zone.

Photo 1

Photo 2

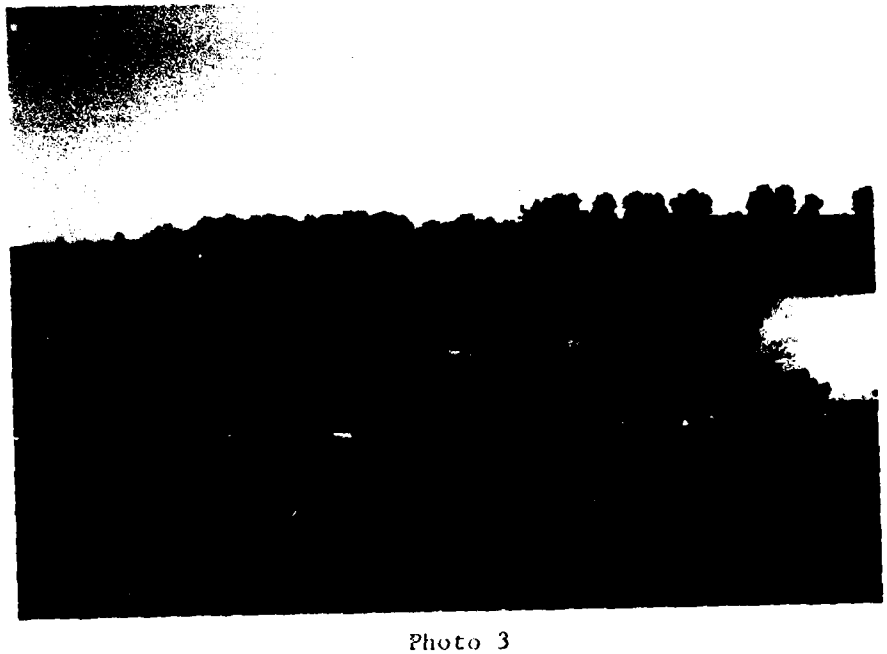


Photo 3

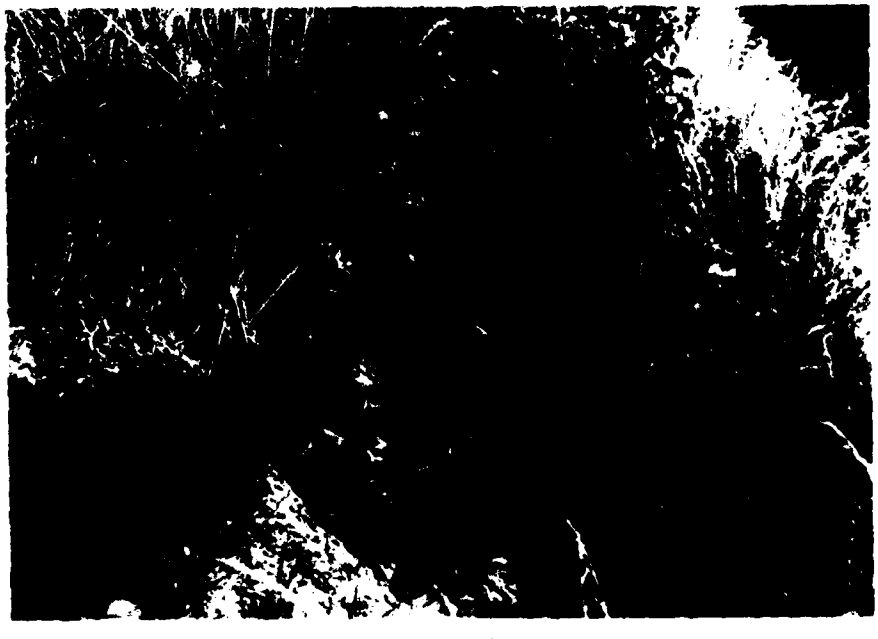


Photo 4

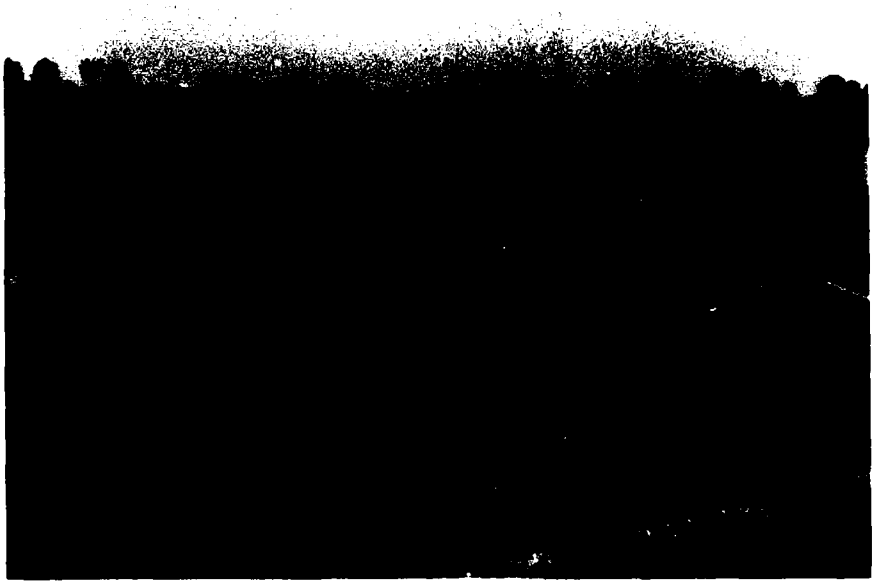


Photo 5

Photo 6

Perry City Dam No. 2

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

PERRY CITY DAM NO. 2

HYDROLOGIC AND HYDRAULIC DATA, ASSUMPTIONS AND METHODOLOGY

1. SCS Unit Hydrograph and HEC-1DB are used to develop the inflow hydrographs, and the hydrologic inputs are as follows:

   (a) Twenty-four hour probable maximum precipitation from Hydrometeorological Report No. 33, 48-hour 100-year rainfall and 48-hour 10-year rainfall of Hannibal, Missouri.

   (b) Drainage area = 2.34 square miles.

   (c) Lag time = 0.72 hour.

   (d) Hydrologic Soil Group:
   Soil Group "D"

   (e) Runoff curve number:
   CN = 84 for AMC II and CN = 93 for AMC III.

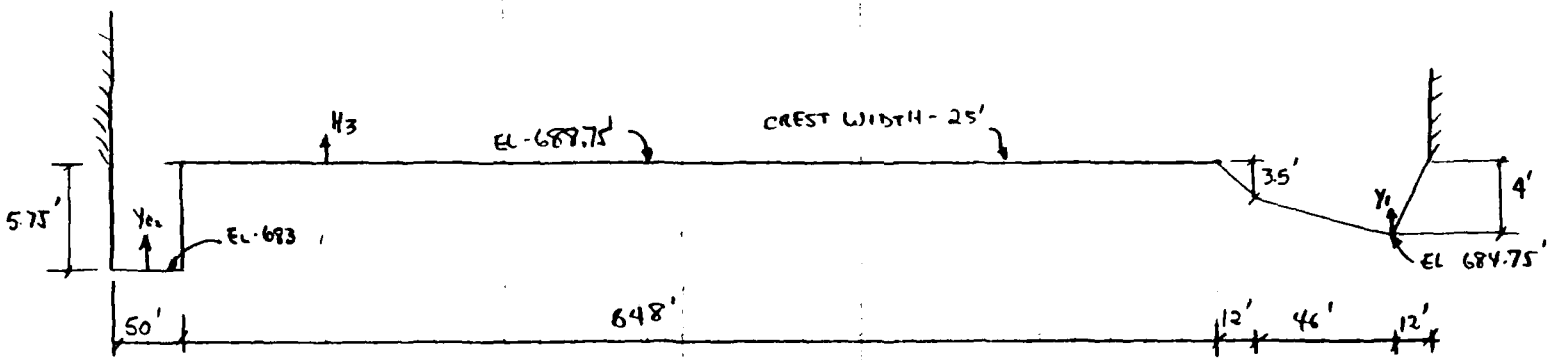
2. Release rates through the emergency spillway are based on open channel flow assuming Manning's n = 0.04. Flow rates through the principal spillway are computed assuming critical depth. Flow rates over the dam are based on broad crested weir equation $Q = CLH^{3/2}$.

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. ___ OF ___

PERRY CITY DAM #2 (Mo 10980) — JOB NO. 1263

SPILLWAY AND OVERTOP RATING CURVE — BY DAC — DATE 7/28/80



FROM HEC2

Y_1	T_1	A_1	V_1	$V_1^2/2g$	$Q_1=V_1A_1$	WSEL	C_3	H_3	L_3	$Q_3=C_3L_3H_3^{3/2}$	Y_{c_2}	A_{c_2}	T_{c_2}	$V_{c_2}\sqrt{A_2/T_2}$	$V_{c_2}^2/2g$	$Q_2=V_2A_2$	$Q_T=Q_1+Q_2+Q_3$
						683.0					0						0
						683.5					.5	25	50	4.0	.25	100.3	100
						684.5					1.0	50	50	5.67	.5	283.7	284
1.3	52.68	52.22	1.91	.06	100	686.1					2.06	103	50	8.14	103	838.88	939
2.08	57.68	95.12	3.15	.15	300	687.6					2.65	132	50	9.29	1.32	1223.2	1523
2.63	61.19	127.61	3.92	.24	500	687.6					3.06	153.4	50	9.94	1.53	1525.4	2025
3.28	65.4	169.04	4.73	.35	800	688.4					3.58	178.8	50	10.73	1.79	1918.3	2718
3.65	67.77	193.63	5.16	.41	1000	688.8	2.91	.07	648'	34.89	3.87	193.4	50	11.16	1.93	2159.1	3193
5.09	70.0	293.68	6.81	.72	2000	690.5	3.04	1.81	648'	4803.3	5.03	251.4	50	12.73	2.51	3199.7	10,003
8.03	70.0	499.87	10.0	1.55	5000	694.3	3.08	5.59	648'	26,350	7.55	377.4	50	15.6	3.77	5884.7	37,235
11.62	70.0	750.19	13.33	2.76	10000	699.1	3.12	10.38	648'	67,548	10.74	537.1	50	18.6	5.37	9989.4	82,537
14.63	70.0	961.94	15.57	3.78	15000	703.1	3.14	14.41	648'	111,247	13.43	671.4	50	20.8	6.71	13962.3	1[illegible]09

B-2

HEC-2 INPUT AND SUMMARY TABLE

```
HEC2 RELEASE DATED NOV 76 UPDATED JULY 1979
ERROR CORR -  01.02.03
MODIFICATION -  00.01.00.03
```

```
J1    DAM SAFETY INSPECTION
J2    PERRY CITY DAM #2
J3    SPILLWAY RATING CURVE
```

	ICHECK	INR	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-1.	2.	0.	0.	-1.000000	0.00	0.0	0.	686.000	0.000

	NPROF	IPLOT	PRFW	PRFS	XSECV	XSECH	FN	ALLOC	IBW	CHNIM	ITRACE
J2	1.000	0.00	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

J3	30.000	0.000	25.000	4.000	20.000	10.000	45.000	3.000	8.000	17.000

	NC	NRT	NUMSEC	REQUESTED SECTION NUMBERS							
		-10.000	-10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		.040	.040	.040	.100	.300	0.000	0.000	0.000	0.000	0.000
	NT	0.000	100.000	400.000	500.000	600.000	1000.000	2000.000	5000.000	10000.000	16000.000

	J1	1.000	0.000	0.000	70.000	0.000	0.000	0.000	0.000	0.000	0.000
	GR	688.750	0.000	685.250	12.000	684.750	68.000	686.750	70.000	0.000	0.000

	J1	2.000	0.000	0.000	0.000	50.000	50.000	50.000	0.000	0.000	0.000
	GR	0.000	0.000	0.000	0.200	0.000	0.000	0.000	0.000	0.000	0.000

HEC2-RELEASE DATED NOV 76 UPDATED JULY 1979
ERROR CODE - 01,02,03
MODIFICATION - 50,51,52,53

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SULLWAY RISING CURVE

SUMMARY PRINTOUT

SECNO	DEPTH	AREA	TOPWID	VCH	HV	Q	EG	IEK-G	K-HVCH	K
1.000	.76	89.89	89.88	4.04	.20	100.00	688.77	301.33	40.00	
1.000	1.11	82.65	52.73	5.70	.50	300.00	686.57	237.77	40.00	
1.000	1.73	75.26	55.42	6.64	.69	500.00	687.17	214.97	40.00	
1.000	2.15	184.92	58.16	7.62	.90	800.00	687.90	197.17	40.00	
1.000	2.55	122.94	60.98	8.13	1.03	1000.00	688.31	189.97	40.00	
1.000	3.80	283.78	68.72	9.82	1.50	2000.00	690.05	167.44	40.00	
1.000	6.24	376.91	70.00	13.27	2.73	5000.00	693.76	149.96	40.00	
1.000	9.95	594.81	70.00	16.78	4.33	10000.00	698.53	130.23	40.00	
1.000	12.18	784.49	70.00	19.12	5.64	15000.00	702.53	124.62	40.00	
2.000	1.38	82.22	98.68	1.92	.04	100.00	646.11	27.11	40.00	
2.000	2.00	85.11	87.67	3.15	.15	300.00	646.59	37.59	40.00	
2.000	2.03	127.59	91.19	4.92	.34	500.00	647.68	42.44	40.00	
2.000	3.28	169.02	65.48	4.73	.35	800.00	648.38	46.64	40.00	
2.000	3.66	193.88	67.90	5.16	.41	1000.00	648.82	48.47	40.00	
2.000	5.09	293.68	70.00	6.81	.72	2000.00	650.56	52.83	40.00	
2.000	8.81	599.89	70.00	10.00	1.58	5000.00	654.54	62.14	40.00	
2.000	11.62	780.15	70.00	13.33	2.76	10000.00	659.13	63.77	40.00	
2.000	14.53	961.94	70.00	15.59	3.78	15000.00	663.16	60.86	40.00	

SUMMARY OF ERRORS

CAUTION SECNO= 1.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 2 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 3 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 4 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 5 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 6 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 7 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 8 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 9 CRITICAL DEPTH ASSUMED

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION - MISSOURI SHEET NO. ____ OF ____

DAM NAME: PERRY CITY DAM 1 / ID NO.: (MO 10980) JOB NO. ____

RESERVOIR ELEVATION - AREA DATA BY DC KLD DATE 7/28/80

ELEV. (M.S.L.) (Ft.)	RESERVOIR SURFACE AREA (Acres)	REMARKS
673	0	Streambed at dam
680	5	USGS Map (Measured)
683.0	9	PRINCIPAL - Spillway Crest (Assumed)
684.75	13	Emergency spillway crest
688.75	18	Top of dam
690	21	USGS Map (Measured)
700	52	USGS Map (Measured)

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF 1

DAM NAME: PERRY CITY DAM (MO 10980) — JOB NO. 1263

UNIT HYDROGRAPH PARAMETERS — BY D.C K.L.B DATE 7/25/80

1) DRAINAGE AREA, $A = 2.34$ sq. mi = (1497 acres)

2) LENGTH OF STREAM, $L = (5.4 \text{ "} \times 2000' = 10{,}800') = 2.05$ mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$H_1 = 748'$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 683'$

5) ELEVATION OF CHANNEL BED AT 0.85L, $E_{85} = 737'$

6) ELEVATION OF CHANNEL BED AT 0.10L, $E_{10} = 689'$

7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10})/0.75L = .59\%$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$$t_c = [(11.9 \times L^3)/(H_1 - H_2)]^{0.385} = \left[\frac{11.9(2.05)^3}{748-683}\right]^{.385} = 1.19 \text{ hr}$$

B) BY VELOCITY ESTIMATE,

SLOPE = .59% $\Rightarrow$ AVG. VELOCITY = 2 fps

$t_c = L/V = 10{,}809/2 \times 3600 = 1.5$ hr

USE $t_c = 1.19$ hr

9) LAG TIME, $t_l = 0.6\, t_c = .72$ hr

10) UNIT DURATION, $D \leq t_l/3 = .24$ hr ≠ 0.083 hr.

USE $D = .25$ hr

11) TIME TO PEAK, $T_p = D/2 + t_l = .84$ hr

12) PEAK DISCHARGE,

$q_p = (484 \times A)/T_p = 1347$ cfs

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1                 A1     DAM SAFETY INSPECTION MISSOURI
    2                 A2     PERRY CITY DAM #2 (MO 10980)
    3                 A3     PMF AND 50 PERCENT PMF
    4                 B    300       0      15       0       0       0       0       0       0       0
    5                 J1     5
    6                 J      1       2       1
    7                 J1     1      .5
    8                 K        MO10980                                       1
    9                 K1     INPUT PRECIPITATION INDEX, RATIOS, AND UNIT HYDROGRAPH PARAMETERS
   10                 M      1       2    2.34            2.34       1                       1
   11                 P            24.4     100     120     130
   12                 T                                                -1     -93
   13                 M2           .72
   14                 X                      1
   15                 K      1 MO10980                                     1
   16                 K1     ROUTE HYDROGRAPH THROUGH PERRY CITY DAM #2 (MO 10980)
   17                 Y                                    1       1
   18                 Y1                                                -683     -1
   19                 Y4   683  683.75   684.5  686.09  686.98  687.6   688.36  688.80  690.54  694.32
   20                 Y4699.11  703.14
   21                 Y5     0     100     284     939    1523    2025    2718    3193   10003   37235
   22                 Y5 82537  140209
   23                 SA     0       5       9      13      18      21      52
   24                 SE   673     680    683  684.75  688.75     690     700
   25                 SS   683
   26                 ID688.75
   27                 K     99
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
  LAST MODIFICATION  08 FEB 79
**********

RUN : DATE= 80/07/30.
      TIME= 08:38.07.
```

DAM SAFETY INSPECTION MISSOURI
PERRY CITY DAM #2 (MO 10988)
PMF AND 80 PERCENT PMF

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
388	0	15	1	0	1	0	0	0	0

JOPER	NRT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS= 1.00 .50

****

SUB-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION INDEX, RATIOS, AND UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
Q10980	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	2.34	0.00	2.34	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.80	24.40	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.80	0.00	0.00	1.00	+1.00	-93.00	0.00	0.00

CURVE NO = -93.00 WETNESS = -1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .72

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 16 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .72 VOL= 1.00

249.	860.	1312.	1255.	936.	544.	339.	210.	130.	80.
49.	31.	19.	12.	8.	4.				

END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.04	0.00	.04	0.	1.02	13.45	181	0.00	0.00	0.00	0.
1.01	.30	2	.04	0.00	.04	0.	1.02	14.00	182	0.00	0.00	0.00	0.
1.01	.45	3	.04	0.00	.04	0.	1.02	14.15	183	0.00	0.00	0.00	0.
1.01	1.00	4	.04	.00	.04	0.	1.02	14.30	184	0.00	0.00	0.00	0.
1.01	1.15	5	.04	.00	.04	1.	1.02	14.45	185	0.00	0.00	0.00	0.
1.01	1.30	6	.04	.01	.03	5.	1.02	15.00	186	0.00	0.00	0.00	0.
1.01	1.45	7	.04	.01	.03	13.	1.02	15.15	187	0.00	0.00	0.00	0.
1.01	2.00	8	.04	.01	.03	25.	1.02	15.30	188	0.00	0.00	0.00	0.
1.01	2.15	9	.04	.02	.03	39.	1.02	15.45	189	0.00	0.00	0.00	0.
1.01	2.30	10	.04	.02	.02	55.	1.02	16.00	190	0.00	0.00	0.00	0.
1.01	2.45	11	.04	.02	.02	69.	1.02	16.15	191	0.00	0.00	0.00	0.
1.01	3.00	12	.04	.02	.02	83.	1.02	16.30	192	0.00	0.00	0.00	0.
1.01	3.15	13	.04	.02	.02	96.	1.02	16.45	193	0.00	0.00	0.00	0.
1.01	3.30	14	.04	.02	.02	107.	1.02	17.00	194	0.00	0.00	0.00	0.
1.01	3.45	15	.04	.02	.02	117.	1.02	17.15	195	0.00	0.00	0.00	0.
1.01	4.00	16	.04	.03	.02	127.	1.02	17.30	196	0.00	0.00	0.00	0.
1.01	4.15	17	.04	.03	.01	135.	1.02	17.45	197	0.00	0.00	0.00	0.
1.01	4.30	18	.04	.03	.01	143.	1.02	18.00	198	0.00	0.00	0.00	0.
1.01	4.45	19	.04	.03	.01	150.	1.02	18.15	199	0.00	0.00	0.00	0.
1.01	5.00	20	.04	.03	.01	156.	1.02	18.30	200	0.00	0.00	0.00	0.
1.01	5.15	21	.04	.03	.01	162.	1.02	18.45	201	0.00	0.00	0.00	0.
1.01	5.30	22	.04	.03	.01	167.	1.02	19.00	202	0.00	0.00	0.00	0.
1.01	5.45	23	.04	.03	.01	171.	1.02	19.15	203	0.00	0.00	0.00	0.
1.01	6.00	24	.04	.03	.01	176.	1.02	19.30	204	0.00	0.00	0.00	0.
1.01	6.15	25	.20	.16	.04	212.	1.02	19.45	205	0.00	0.00	0.00	0.
1.01	6.30	26	.20	.17	.03	330.	1.02	20.00	206	0.00	0.00	0.00	0.
1.01	6.45	27	.20	.19	.03	513.	1.02	20.15	207	0.00	0.00	0.00	0.
1.01	7.00	28	.20	.18	.02	696.	1.02	20.30	208	0.00	0.00	0.00	0.
1.01	7.15	29	.20	.18	.02	843.	1.02	20.45	209	0.00	0.00	0.00	0.
1.01	7.30	30	.20	.19	.02	940.	1.02	21.00	210	0.00	0.00	0.00	0.
1.01	7.45	31	.20	.19	.01	1008.	1.02	21.15	211	0.00	0.00	0.00	0.
1.01	8.00	32	.20	.19	.01	1056.	1.02	21.30	212	0.00	0.00	0.00	0.
1.01	8.15	33	.20	.19	.01	1091.	1.02	21.45	213	0.00	0.00	0.00	0.
1.01	8.30	34	.20	.19	.01	1117.	1.02	22.00	214	0.00	0.00	0.00	0.
1.01	8.45	35	.20	.19	.01	1136.	1.02	22.15	215	0.00	0.00	0.00	0.
1.01	9.00	36	.20	.20	.01	1150.	1.02	22.30	216	0.00	0.00	0.00	0.
1.01	9.15	37	.20	.20	.01	1161.	1.02	22.45	217	0.00	0.00	0.00	0.
1.01	9.30	38	.20	.20	.01	1170.	1.02	23.00	218	0.00	0.00	0.00	0.
1.01	9.45	39	.20	.20	.01	1177.	1.02	23.15	219	0.00	0.00	0.00	0.
1.01	10.00	40	.20	.20	.01	1183.	1.02	23.30	220	0.00	0.00	0.00	0.
1.01	10.15	41	.20	.20	.00	1187.	1.02	23.45	221	0.00	0.00	0.00	0.
1.01	10.30	42	.20	.20	.00	1191.	1.03	0.00	222	0.00	0.00	0.00	0.
1.01	10.45	43	.20	.20	.00	1194.	1.03	.15	223	0.00	0.00	0.00	0.
1.01	11.00	44	.20	.20	.00	1197.	1.03	.30	224	0.00	0.00	0.00	0.
1.01	11.15	45	.20	.20	.00	1200.	1.03	.45	225	0.00	0.00	0.00	0.
1.01	11.30	46	.20	.20	.00	1202.	1.03	1.00	226	0.00	0.00	0.00	0.
1.01	11.45	47	.20	.20	.00	1204.	1.03	1.15	227	0.00	0.00	0.00	0.
1.01	12.00	48	.20	.20	.00	1205.	1.03	1.30	228	0.00	0.00	0.00	0.
1.01	12.15	49	.61	.60	.01	1387.	1.03	1.45	229	0.00	0.00	0.00	0.
1.01	12.30	50	.61	.60	.01	1659.	1.03	2.00	230	0.00	0.00	0.00	0.
1.01	12.45	51	.61	.60	.01	2184.	1.03	2.15	231	0.00	0.00	0.00	0.
1.01	13.00	52	.61	.61	.00	2691.	1.03	2.30	232	0.00	0.00	0.00	0.
1.01	13.15	53	.73	.73	.00	3101.	1.03	2.45	233	0.00	0.00	0.00	0.
1.01	13.30	54	.73	.73	.00	3429.	1.03	3.00	234	0.00	0.00	0.00	0.
1.01	13.45	55	.73	.73	.00	3728.	1.03	3.15	235	0.00	0.00	0.00	0.
1.01	14.00	56	.73	.73	.00	3968.	1.03	3.30	236	0.00	0.00	0.00	0.

1.01	14.15	57	.92	.91	.00	11854.	1.03	3.45	207	0.00	0.00	0.00	0.				
1.01	14.30	58	.92	.91	.00	10611.	1.03	4.00	208	0.00	0.00	0.00	0.				
1.01	14.45	59	.88	.88	.00	9765.	1.03	4.15	209	0.00	0.00	0.00	0.				
1.01	15.00	60	.92	.91	.00	8814.	1.03	4.30	210	0.00	0.00	0.00	0.				
1.01	15.15	61	.93	.93	.00	8214.	1.03	4.45	211	0.00	0.00	0.00	0.				
1.01	15.30	62	1.85	1.85	.00	8870.	1.03	5.00	212	0.00	0.00	0.00	0.				
1.01	15.45	63	5.19	5.19	.01	7289.	1.03	5.15	213	0.00	0.00	0.00	0.				
1.01	16.00	64	1.30	1.30	.00	10461.	1.03	5.30	214	0.00	0.00	0.00	0.				
1.01	16.15	65	.88	.88	.00	12588.	1.03	5.45	215	0.00	0.00	0.00	0.				
1.01	16.30	66	.85	.85	.00	12172.	1.03	6.00	216	0.00	0.00	0.00	0.				
1.01	16.45	67	.85	.85	.00	10347.	1.03	6.15	217	0.00	0.00	0.00	0.				
1.01	17.00	68	.85	.85	.00	8289.	1.03	6.30	218	0.00	0.00	0.00	0.				
1.01	17.15	69	.67	.67	.00	7043.	1.03	6.45	219	0.00	0.00	0.00	0.				
1.01	17.30	70	.67	.67	.00	6140.	1.03	7.00	220	0.00	0.00	0.00	0.				
1.01	17.45	71	.67	.67	.00	5483.	1.03	7.15	221	0.00	0.00	0.00	0.				
1.01	18.00	72	.67	.67	.00	4936.	1.03	7.30	222	0.00	0.00	0.00	0.				
1.01	18.15	73	.06	.06	.00	4440.	1.03	7.45	223	0.00	0.00	0.00	0.				
1.01	18.30	74	.06	.06	.00	3709.	1.03	8.00	224	0.00	0.00	0.00	0.				
1.01	18.45	75	.06	.06	.00	2780.	1.03	8.15	225	0.00	0.00	0.00	0.				
1.01	19.00	76	.06	.06	.00	1930.	1.03	8.30	226	0.00	0.00	0.00	0.				
1.01	19.15	77	.06	.06	.00	1316.	1.03	8.45	227	0.00	0.00	0.00	0.				
1.01	19.30	78	.06	.06	.00	946.	1.03	9.00	228	0.00	0.00	0.00	0.				
1.01	19.45	79	.06	.06	.00	713.	1.03	9.15	229	0.00	0.00	0.00	0.				
1.01	20.00	80	.06	.06	.00	578.	1.03	9.30	230	0.00	0.00	0.00	0.				
1.01	20.15	81	.06	.06	.00	496.	1.03	9.45	231	0.00	0.00	0.00	0.				
1.01	20.30	82	.06	.06	.00	448.	1.03	10.00	232	0.00	0.00	0.00	0.				
1.01	20.45	83	.06	.06	.00	413.	1.03	10.15	233	0.00	0.00	0.00	0.				
1.01	21.00	84	.06	.06	.00	394.	1.03	10.30	234	0.00	0.00	0.00	0.				
1.01	21.15	85	.06	.06	.00	382.	1.03	10.45	235	0.00	0.00	0.00	0.				
1.01	21.30	86	.06	.06	.00	375.	1.03	11.00	236	0.00	0.00	0.00	0.				
1.01	21.45	87	.06	.06	.00	370.	1.03	11.15	237	0.00	0.00	0.00	0.				
1.01	22.00	88	.06	.06	.00	368.	1.03	11.30	238	0.00	0.00	0.00	0.				
1.01	22.15	89	.06	.06	.00	368.	1.03	11.45	239	0.00	0.00	0.00	0.				
1.01	22.30	90	.06	.06	.00	368.	1.03	12.00	240	0.00	0.00	0.00	0.				
1.01	22.45	91	.06	.06	.00	368.	1.03	12.15	241	0.00	0.00	0.00	0.				
1.01	23.00	92	.06	.06	.00	368.	1.03	12.30	242	0.00	0.00	0.00	0.				
1.01	23.15	93	.06	.06	.00	368.	1.03	12.45	243	0.00	0.00	0.00	0.				
1.01	23.30	94	.06	.06	.00	368.	1.03	13.00	244	0.00	0.00	0.00	0.				
1.01	23.45	95	.06	.06	.00	368.	1.03	13.15	245	0.00	0.00	0.00	0.				
1.02	0.00	96	.06	.06	.00	368.	1.03	13.30	246	0.00	0.00	0.00	0.				
1.02	.15	97	0.00	0.00	0.00	353.	1.03	13.45	247	0.00	0.00	0.00	0.				
1.02	.30	98	0.00	0.00	0.00	300.	1.03	14.00	248	0.00	0.00	0.00	0.				
1.02	.45	99	0.00	0.00	0.00	220.	1.03	14.15	249	0.00	0.00	0.00	0.				
1.02	1.00	100	0.00	0.00	0.00	144.	1.03	14.30	250	0.00	0.00	0.00	0.				
1.02	1.15	101	0.00	0.00	0.00	87.	1.03	14.45	251	0.00	0.00	0.00	0.				
1.02	1.30	102	0.00	0.00	0.00	54.	1.03	15.00	252	0.00	0.00	0.00	0.				
1.02	1.45	103	0.00	0.00	0.00	33.	1.03	15.15	253	0.00	0.00	0.00	0.				
1.02	2.00	104	0.00	0.00	0.00	20.	1.03	15.30	254	0.00	0.00	0.00	0.				
1.02	2.15	105	0.00	0.00	0.00	12.	1.03	15.45	255	0.00	0.00	0.00	0.				
1.02	2.30	106	0.00	0.00	0.00	7.	1.03	16.00	256	0.00	0.00	0.00	0.				
1.02	2.45	107	0.00	0.00	0.00	4.	1.03	16.15	257	0.00	0.00	0.00	0.				
1.02	3.00	108	0.00	0.00	0.00	3.	1.03	16.30	258	0.00	0.00	0.00	0.				
1.02	3.15	109	0.00	0.00	0.00	1.	1.03	16.45	259	0.00	0.00	0.00	0.				
1.02	3.30	110	0.00	0.00	0.00	1.	1.03	17.00	260	0.00	0.00	0.00	0.				
1.02	3.45	111	0.00	0.00	0.00	0.	1.03	17.15	261	0.00	0.00	0.00	0.				
1.02	4.00	112	0.00	0.00	0.00	0.	1.03	17.30	262	0.00	0.00	0.00	0.				
1.02	4.15	113	0.00	0.00	0.00	0.	1.03	17.45	263	0.00	0.00	0.00	0.				
1.02	4.30	114	0.00	0.00	0.00	0.	1.03	18.00	264	0.00	0.00	0.00	0.				
1.02	4.45	115	0.00	0.00	0.00	0.	1.03	18.15	265	0.00	0.00	0.00	0.				
1.02	5.00	116	0.00	0.00	0.00	0.	1.03	18.30	266	0.00	0.00	0.00	0.				

1.02	5.15	117	0.00	0.00	0.00	0.	1.03	18.45	257	0.00	0.00	0.00	0.			
1.02	5.30	118	0.00	0.00	0.00	0.	1.03	19.00	268	0.00	0.00	0.00	0.			
1.02	5.45	119	0.00	0.00	0.00	0.	1.03	19.15	269	0.00	0.00	0.00	0.			
1.02	6.00	120	0.00	0.00	0.00	0.	1.03	19.30	270	0.00	0.00	0.00	0.			
1.02	6.15	121	0.00	0.00	0.00	0.	1.03	19.45	271	0.00	0.00	0.00	0.			
1.02	6.30	122	0.00	0.00	0.00	0.	1.03	20.00	272	0.00	0.00	0.00	0.			
1.02	6.45	123	0.00	0.00	0.00	0.	1.03	20.15	273	0.00	0.00	0.00	0.			
1.02	7.00	124	0.00	0.00	0.00	0.	1.03	20.30	274	0.00	0.00	0.00	0.			
1.02	7.15	125	0.00	0.00	0.00	0.	1.03	20.45	275	0.00	0.00	0.00	0.			
1.02	7.30	126	0.00	0.00	0.00	0.	1.03	21.00	276	0.00	0.00	0.00	0.			
1.02	7.45	127	0.00	0.00	0.00	0.	1.03	21.15	277	0.00	0.00	0.00	0.			
1.02	8.00	128	0.00	0.00	0.00	0.	1.03	21.30	278	0.00	0.00	0.00	0.			
1.02	8.15	129	0.00	0.00	0.00	0.	1.03	21.45	279	0.00	0.00	0.00	0.			
1.02	8.30	130	0.00	0.00	0.00	0.	1.03	22.00	280	0.00	0.00	0.00	0.			
1.02	8.45	131	0.00	0.00	0.00	0.	1.03	22.15	281	0.00	0.00	0.00	0.			
1.02	9.00	132	0.00	0.00	0.00	0.	1.03	22.30	282	0.00	0.00	0.00	0.			
1.02	9.15	133	0.00	0.00	0.00	0.	1.03	22.45	283	0.00	0.00	0.00	0.			
1.02	9.30	134	0.00	0.00	0.00	0.	1.03	23.00	284	0.00	0.00	0.00	0.			
1.02	9.45	135	0.00	0.00	0.00	0.	1.03	23.15	285	0.00	0.00	0.00	0.			
1.02	10.00	136	0.00	0.00	0.00	0.	1.03	23.30	286	0.00	0.00	0.00	0.			
1.02	10.15	137	0.00	0.00	0.00	0.	1.03	23.45	287	0.00	0.00	0.00	0.			
1.02	10.30	138	0.00	0.00	0.00	0.	1.04	0.00	288	0.00	0.00	0.00	0.			
1.02	10.45	139	0.00	0.00	0.00	0.	1.04	.15	289	0.00	0.00	0.00	0.			
1.02	11.00	140	0.00	0.00	0.00	0.	1.04	.30	290	0.00	0.00	0.00	0.			
1.02	11.15	141	0.00	0.00	0.00	0.	1.04	.45	291	0.00	0.00	0.00	0.			
1.02	11.30	142	0.00	0.00	0.00	0.	1.04	1.00	292	0.00	0.00	0.00	0.			
1.02	11.45	143	0.00	0.00	0.00	0.	1.04	1.15	293	0.00	0.00	0.00	0.			
1.02	12.00	144	0.00	0.00	0.00	0.	1.04	1.30	294	0.00	0.00	0.00	0.			
1.02	12.15	145	0.00	0.00	0.00	0.	1.04	1.45	295	0.00	0.00	0.00	0.			
1.02	12.30	146	0.00	0.00	0.00	0.	1.04	2.00	296	0.00	0.00	0.00	0.			
1.02	12.45	147	0.00	0.00	0.00	0.	1.04	2.15	297	0.00	0.00	0.00	0.			
1.02	13.00	148	0.00	0.00	0.00	0.	1.04	2.30	298	0.00	0.00	0.00	0.			
1.02	13.15	149	0.00	0.00	0.00	0.	1.04	2.45	299	0.00	0.00	0.00	0.			
1.02	13.30	150	0.00	0.00	0.00	0.	1.04	3.00	300	0.00	0.00	0.00	0.			
									SUM	31.72	30.83	.89	186148.			
										(806.1(	783.1(	22.9(	8271.12)			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12580.	5893.	1938.	646.	186153.
CMS	356.	167.	55.	18.	5271.
INCHES		23.43	30.82	30.83	30.83
MM		595.03	782.89	783.19	783.19
AC-FT		2922.	3846.	3846.	3846.
THOUS CU M		3604.	4742.	4744.	4744.

HYDROGRAPH AT BTA010980 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	1.	5.	15.	25.	39.	58.
69.	83.	96.	107.	117.	127.	135.	143.	150.	156.
162.	167.	171.	176.	212.	338.	513.	696.	843.	940.
1008.	1056.	1091.	1117.	1135.	1150.	1161.	1170.	1177.	1183.
1187.	1191.	1194.	1197.	1200.	1202.	1204.	1205.	1307.	1654.
2184.	2691.	3101.	3429.	3728.	3968.	4183.	4441.	4745.	5014.
5214.	5570.	7285.	10461.	12580.	12172.	10347.	8289.	7043.	6140.
5453.	4956.	4440.	3709.	2780.	1938.	1316.	846.	713.	578.
496.	445.	413.	394.	382.	375.	370.	368.	368.	368.
368.	368.	368.	368.	368.	368.	353.	300.	220.	144.
87.	54.	33.	20.	12.	7.	4.	3.	1.	1.

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12580.	5893.	1938.	646.	186183.
CMS	356.	167.	55.	18.	5271.
INCHES		23.43	30.82	30.83	30.83
MM		595.03	782.89	783.19	783.19
AC-FT		2922.	3845.	3846.	3846.
THOUS CU M		3604.	4742.	4744.	4744.

HYDROGRAPH AT STA010980 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	2.	6.	13.	20.	27.
35.	41.	48.	58.	59.	63.	68.	71.	75.	78.
81.	83.	86.	88.	106.	165.	257.	348.	422.	470.
504.	528.	546.	558.	568.	575.	581.	585.	589.	591.
594.	595.	597.	599.	600.	601.	602.	603.	653.	827.
1092.	1346.	1551.	1714.	1864.	1984.	2092.	2221.	2372.	2587.
2607.	2785.	3642.	5230.	6290.	6086.	5173.	4144.	3522.	3074.
2727.	2468.	2220.	1854.	1390.	969.	658.	473.	357.	289.
248.	222.	207.	197.	191.	187.	185.	184.	184.	184.
184.	184.	184.	184.	184.	184.	176.	150.	110.	72.
43.	27.	17.	10.	6.	4.	2.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6290.	2946.	969.	323.	93076.
CMS	178.	83.	27.	9.	2636.
INCHES	11.71	15.41	18.42	18.42	18.42
MM	297.57	391.40	391.60	391.60	391.60
AC-FT	14614.	19228.	1923.	1923.	1923.
THOUS CU M	1802.	2371.	9378.	9378.	9378.

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH PERRY CITY DAM #2 IHD 109867

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
010980	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.00	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
0	0	0	0.000	0.000	0.000	-683.	-1

STAGE	683.00	683.75	684.50	686.09	686.98	687.60	688.36	688.80	690.56	696.32
	699.11	703.14								
FLOW	0.00	100.00	200.00	952.00	1523.00	2085.00	2718.00	3193.00	10805.00	37236.00
	82857.00	140209.00								
SURFACE AREA=	0.	5.	9.	13.	18.	21.	52.			
CAPACITY=	0.	12.	32.	92.	113.	138.	491.			
ELEVATION=	673.	680.	683.	685.	689.	690.	700.			

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
683.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
698.0	0.0	0.0	0.

STATION 010980, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	1.	3.	7.	14.	22.	
32.	43.	55.	66.	77.	88.	98.	112.	125.	135.	
149.	151.	158.	164.	174.	209.	283.	443.	601.	738.	
847.	932.	1019.	1072.	1106.	1129.	1145.	1158.	1168.	1175.	
1181.	1186.	1190.	1194.	1196.	1199.	1201.	1203.	1236.	1386.	
1735.	2225.	2702.	3135.	3699.	3904.	4139.	4376.	4672.	4954.	
5171.	5470.	6754.	9536.	12489.	12317.	10699.	8800.	7310.	6360.	

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	010980	2.34	1	12580.	6290.
		6.06	1	356.26)	178.12)
ROUTED TO	010988	2.34	1	12489.	6225.
		6.06	1	353.68)	176.27)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	688.00	683.00	688.78
STORAGE	32.	32.	113.
OUTFLOW	0.	0.	5139.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	690.89	2.14	187.	12469.	5.00	16.25	0.00
.88	689.57	.82	129.	6225.	1.75	16.58	0.00

HEC-1 FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
CARI MODIFICATION 26 FEB 79

RUN DATE= 80/07/30.
TIME= 09.19.17

DAM SAFETY INSPECTION MISSOURI
PERRY CITY DAM ID NO 10980
PERCENT PMF

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-9	0

JOPER	NUT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLANS 1 NRTIOS 6 LRTIOS 1

RTIOS= .15, .20, .25, .30, .35, .40

SUB-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION INDEX, RATIOS, AND UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
010980	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	1	2.34	0.00	2.34	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.40	100.00	120.00	150.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-93.00	0.00	0.00

CURVE NO = -93.00 HUTNESS = -1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .72

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

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                                                        SUM   31.72   30.63   [illegible].89   100146.
                                                            ( 806.)(  783.)(   22.)( 8271.12)

     *********          *********          *********          *********          *********

                                   HYDROGRAPH ROUTING

              ROUTE HYDROGRAPH THROUGH PERRY CITY DAM #8 (MO 10980)

                        ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME  ISTAGE  IAUTO
                       010980       1       0       0      0       0       1       0      0
                                          ROUTING DATA
              QLOSS    CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                0.0    0.000    0.00       1       1       0       0               0

                        NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                            0       0       0   0.000   0.000   0.000   -683.      -1

     STAGE    683.00    683.75    684.50    686.09    686.98    687.60    688.36    688.88    690.84    694.32
              699.11    703.14

      FLOW      0.00    100.00    284.00    939.00   1883.00   2825.00   8710.00   3193.00  18003.00  37235.00
            82537.00  140209.00

SURFACE AREA=      0.        5.        9.       13.       18.       21.       32.

    CAPACITY=      0.       12.       32.       82.      113.      138.      431.

   ELEVATION=    673.      680.      683.      685.      689.      698.      700.

                   CREL    SPWID    COQW    EXPW    ELEVL    COOL    CAREA    EXPL
                  683.0      0.0     0.0     0.0      0.0     0.0      0.0     0.0

                                          DAM DATA
                                 TOPEL    COQD    EXPD   DAMWID
                                 688.8     0.0     0.0       0.

   PEAK OUTFLOW IS     1741. AT TIME  16.50 HOURS

   PEAK OUTFLOW IS     2561. AT TIME  16.50 HOURS

   PEAK OUTFLOW IS     2978. AT TIME  16.50 HOURS

   PEAK OUTFLOW IS     3906. AT TIME  16.50 HOURS

   PEAK OUTFLOW IS     4381. AT TIME  16.50 HOURS

   PEAK OUTFLOW IS     5077. AT TIME  16.25 HOURS
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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1 .15	RATIO 2 .20	RATIO 3 .26	RATIO 4 .30	RATIO 5 .38	RATIO 6 .40
HYDROGRAPH AT	010988	2.34	1	1887.	2516.	3148.	3774.	4908.	5032.
		6.06)	1	53.44)	71.25)	89.08)	106.87)	138.98)	142.50)
ROUTED TO	010988	2.34	1	1741.	2361.	2978.	3906.	4381.	6077.
		6.06)	1	49.29)	66.87)	84.33)	110.62)	124.08)	193.77)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	683.00	683.00	686.76
STORAGE	32.	32.	113.
OUTFLOW	0.	0.	8139.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.18	687.25	0.00	88.	1741.	0.00	16.50	0.00
.28	687.57	0.00	100.	4361.	0.00	16.50	0.00
.25	688.60	0.00	111.	2978.	0.00	16.50	0.00
.38	688.98	.23	117.	3986.	.75	16.50	0.00
.35	689.10	.35	120.	4381.	.75	16.50	0.00
.40	689.28	.53	123.	5877.	1.28	16.25	0.00

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DATE
ILME